# The Madras Agricultural Journal.

(ORGAN OF THE M. A. S. UNION)

Vol. XXVII.] APRIL 1939 [No. 4.

## EDITORIAL

The motion made by the Hon'ble Minister for Development for a grant of Rs. 20 lakhs for the Madras Agricultural department elicited a full discussion on the activities and the policy of the department. Such a frank discussion was welcome in that it gave those in charge of the Department a chance to learn what the representatives of the people think of the Department and for the Minister for Development to acquaint the Assembly with the recent achievements of the Department and to make a spirited defence of Government's policy. The old complaint that the great gulf between the experimental stations and the ryots remains unbridged was repeated. While this is partially true of Madras as of every province in India critics have to realise the immensity of the task before the Agricultural officers and the miserably inadequate finances at their disposal. The money spent on Agricultural research, education and propaganda in this province works at less than 6 pies per year per head of population and it could well be realised that the department cannot go very far with the limited means at its disposal. Despite this handicap there is one demonstrator for each taluk with a band of demonstration maistries under him. The research institute at Coimbatore is adding to its reputation by releasing new strains of seed and the results of several pieces of valuable research. It was gratifying that several members of the Assembly thought it fit to congratulate the ministry on its achievements. Mr. Reid who produced in the Assembly hall a 300 page volume of the " Villagers' Calendar " offered special congratulations to the Department in being able to issue such a fund of valuable information translated into four languages at the nominal price of one anna per copy. It is indeed gratifying to us that there is an increasing interest displayed by the public in the matters of Agriculture and that despite the recent use of the axe in several quarters the department is ready to cope with such increased demand.

# Border Effect on the Crop in Irrigated Sorghum.

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The summer sorghum crop is grown only under irrigation in Coimbatore. In forming the bunded plots for experiments, alleys between the plots are a necessity. The space between plots is indispensable to prevent the breach of one plot into the other, and the mixing of seeds. Part of the soil required to form the bund is scraped from the alley. The plants at the border of a plot thus get a two-fold advantage over those in the interior, the extra space, and the additional soil surface thrown over it from the alley.

It is well known that border plants manifest extra vigour. In the yield trials conducted in a summer season in irrigated plots the question arises whether the borders will not vitiate the results, if the differential response of varieties to spatial restrictions is considerable. The principle of including or excluding the borders needs to be settled. If the exclusion of borders is decided upon, to what extent in a plot must the term border be applied. It is also necessary to determine the effect of border on some important aspects, besides earhead yield, like straw yield. These are the problems discussed in this paper.

**Review of previous work.** In the yields of plots of kafir and milo in the crop rotation and cultural experiments at the Hays Branch Station in Kansas, it was observed that in general the outside rows of a plot yield more than the inside rows. The excess yield of grain from the outside rows as compared with the inside rows was proportionately much greater than the excess of yield of stover of the outside rows over the inner rows (Cole and Hallstead, 1926.)

**Material and Method.** At the Millets Breeding Station an experiment was designed in the summer of 1928 to determine to what extent the border effect is felt within a plot. Two different strains, A. S. 795 (yellow grain) and A. S. 1543 (white grain) were sown in two blocks. In each, there were 11 plots of length 70 links and these varied from 1 to 11 sowing lines per plot with two links between the lines. The space between the plots was 4 links The grain and straw yield, and the number of plants were recorded in each line; the height of each plant was also measured.

In the summer of 1933 two series of comparative trials, namely, yellow and white grain varieties were conducted. There were three strains in each series in eight randomized blocks. The plots were 79 links long and

14 links broad ; each plot consisted of six sowing lines 2 links apart. The area of a plot was 1·1 cents. The space between the plots was 4 links. In the summer of the following year, four series of comparative trials, white, yellow and red grain varieties, were conducted. There were four strains in each series in 6 randomized blocks. The plots were 71 links long and 14 links wide with six sowing lines 2 links apart in each plot. The area of a plot was 1 cent. The space between plots was 4 links.

The six comparative trials are for convenience of reference here given by the series A, B, C, D, E, F.

The two marginal rows and the four inner rows were recorded separately for earhead yield, number of plants, and weight of straw.

The total variation in a factor is resolved into the components due to position, varieties, blocks, position variety interaction, and error, and the analysis of variance is adopted for testing the significance of the several variations. The level of significance is taken at P = ·05.

**Discussion. Extent of the border effect in a plot and the influence of plot size.** In the first experiment (1928 summer) described above, it is found (Appendices I & II) that only the outermost rows in a plot yield grain and straw significantly above the inner rows. The penultimate rows at either sides of a plot do not show any significant increase over the inner rows; neither does any subsequent row within. The term "border" should rightly be applied only to the extreme rows of a plot. The border influence does not extend beyond the first line. The least of the border rows in a plot is greater than the greatest of the central rows in respect of grain yield.

The size of plot was varied from ·14 cent to 1·54 cents, with the number of rows per plot varying at the same time from 1 to 11, to determine whether the plot size would influence the difference between the border and the inner rows. The correlations between these differences and the size of the plot are given below :—

| *Correlates.* | *Correlation.* A. S. 795 | A. S. 1543 |
|---|---|---|
| Size of plot and the difference between border and centre rows in weight of grain. ... ... | ·59 | ·27 |
| do. do. in height of plant. ... ... | ·28 | ·05 |
| do. do. in weight of straw. ... ... | ·12 | ·61 |

In all cases the correlations are not significant. By how much the border row excels the inner row does not seem to depend on the size of the plot.

Following the above conclusions that only the extreme rows constitute the 'borders' and that the size of plot has no influence on the border effect,

an analysis of border effect was undertaken on the data of the comparative trials of 1933 and 1934 described above. The border effect on earhead yield, average earhead weight per plant, straw yield and the height of the plant will now be discussed.

**Earhead Yield.** The first step is to examine whether the inclusion of borders of a plot alters the results arrived at from the inner row yields only, by the application of the analysis of variance method. The procedure is well known. Table I presents the results of the analysis of variance of earhead yield of a plot with and without the borders.

**TABLE I. Summary of the Analysis of Variance of Earhead Yield with and without Borders.**

| Trial Series. | Whether varietal differences are significant or not. | | Coefficient of variation per plot. | |
|---|---|---|---|---|
| | Border excluded. | Border included. | Border excluded. % | Border included. % |
| A | Not significant | Not significant | 11 6 | 9·4 |
| B | Significant | Significant | 13·3 | 10·0 |
| C | " | " | 9·3 | 6·5 |
| D | " | " | 6 6 | 6·1 |
| E | " | " | 7·7 | 5·1 |
| F | " | " | 5·6 | 4·7 |

The coefficient of variation of the entire plot is always less than that of the plot with the borders excluded.

It is found that the conclusions arrived at by tests of significance on inner plot yields, are not altered by the inclusion of margins.

**TABLE II. Summary of the Analysis of Variance of Earhead Yield comparing Border and Centre.**

| Trial Series. | Whether significant or not. Variation due to:— | |
|---|---|---|
| | Position (Border vs. Centre). | Interaction (Position Variety). |
| A | Significant | Significant |
| B | " | " |
| C | " | " |
| D | " | Not significant |
| E | " | Significant |
| F | " | |

The second step in analysing the data of an yield trial is to find the relative merits of varieties. From Table II it is seen that the positional (border vs. centre) variance in all the cases deviates widely from the error variance, P being far less than ·05. The increase of the border row over the central row varies from 47 to 114%.

TABLE III. **Earhead Yield with and without Borders.**

| Series. | Strain No. | Central Row Yield oz. | Border plus Central Row Yield oz | Increase of Border over Centre % |
|---|---|---|---|---|
| @A | A. S. 809 | 2526 | 2413 | 50 |
| Yellow | A. S. 818 | 2504 | 2595 | 79 |
| grain | A. S 805 | 2296 | 2318 | 69 |
| @B | Mixture* | 3414 | 3392 | 51 |
| White | A. S 3023 | 2834 | 2887 | 61 |
| grain | A. S. 1575 | 1832 | 1801 | 47 |
| @C | A. S 1575 | 2132 | 2120 | 94 |
| White | A. S. 391 | 1780 | 1817 | 103 |
| grain | Mixture* | 1744 | 1640 | 103 |
| | A. S. 3106 | 1542 | 1479 | 79 |
| D | A. S. 2095 | 2250 | 2236 | 93 |
| White | A. S. 3023 | 2112 | 2125 | 98 |
| grain | A. S. 1059 | 1948 | 2007 | 107 |
| | A. S. 367 | 1908 | 1849 | 94 |
| E | A. S. 1295 | 1940 | 1898 | 81 |
| Yellow | A. S. 809 | 1796 | 1738 | 77 |
| grain | A. S. 2157 | 1646 | 1654 | 91 |
| | A. S. 818 | 1422 | 1514 | 114 |
| F | A. S. 389 | 2780 | 2726 | 62 |
| Red | A. S. 841 | 2608 | 2694 | 81 |
| grain | M. S. 1690 | 2464 | 2483 | 72 |
| | M. S. 1688 | 2318 | 2267 | 61 |

* Mixture of A. S. 1539, A. S. 1540 and A. S. 1543.

@ Position X variety interaction significant.

In Table II there is found a significant interaction between position and variety in 4 out of the 6 series. A significant interaction will alter the relative yields of varieties as is seen from Table III, where the yields are given with and without borders, to a common total. In one yellow grain series, the increase of the border row over the centre row varies as widely as 50% to 79%. In view of these facts, it is recommended that the borders be excluded from the plots for arriving at right conclusions.

**Earhead weight per plant.** It was observed that the individual earhead was heavier in the borders than in the centres. It is seen from Table IV that the positional variance is significant. The interaction between position and variety is also significant with one exception.

TABLE IV. **Summary of the Analysis of Variance of Earhead Yield per Plant in Border and Centre.**

| Series. | Whether significant or not — Variation due to:— Position (Border vs. Centre). | Interaction (Position x Variety). |
|---|---|---|
| A | Significant | Significant |
| B | ,, | ,, |
| C | ,, | ,, |
| D | ,, | ,, |
| E | ,, | Not Significant |
| F | ,, | Significant |

The increase of head weight in the border rows, is different in different varieties.

**Straw Yield.** In the trials of sorghum varieties, the produce of straw which is an important fodder, must be reckoned alongside the yield of grain. The border effect on this factor also must be known. Table V presents the results of the analysis of variance of straw yields at harvest. A border doubtless produces more straw than an inner row; the increase varies from 27 to 66 % (Table VI). The border effect on straw though considerable, is not as great as the effect on grain yield. This is as reported by Coles and Hallstead (1926) in kafir and milo experiments. The interaction between variety and position is in three cases significant and in three cases not. The recommendation to exclude the earhead yield of border rows in experimental trials is in fact general and holds for straw yield as well.

**TABLE V. Summary of the Analysis of Variance of Straw Yield in Border and Centre.**

| Series. | Whether significant or not — Variation due to:— Position (Border vs. Centre) | Interaction (Position x Variety). |
|---|---|---|
| A | Significant | Significant |
| B | " | Not Significant |
| C | " | " |
| D | " | Significant |
| E | " | Not Significant |
| F | " | Significant |

**TABLE VI. Straw Yield—Border vs. Centre.**

| Series. | Strain No. | Central two rows yield. | Border two rows yield. | Increase Border over Centre | Increase % |
|---|---|---|---|---|---|
| | | oz. | oz. | oz. | |
| A | A. S. 818 | 5098 | 7890 | 2792 | 55 |
| | A. S. 805 | 4592 | 6376 | 1784 | 39 |
| | A. S. 809 | 4524 | 6216 | 1692 | 37 |
| B | Mixture | 3930 | 5226 | 1296 | 33 |
| | A. S. 3023 | 3435 | 4400 | 965 | 28 |
| | A. S. 1575 | 3883 | 4947 | 1064 | 27 |
| C | A. S. 391 | 3944 | 6560 | 2616 | 66 |
| | A. S. 1575 | 3679 | 5776 | 2097 | 57 |
| | Mixture | 4228 | 6532 | 2304 | 54 |
| | A. S. 3106 | 5112 | 7392 | 2280 | 45 |
| D | A. S. 2095 | 3984 | 6272 | 2288 | 57 |
| | A. S. 367 | 4160 | 6496 | 2336 | 56 |
| | A. S. 3023 | 4040 | 6272 | 2232 | 55 |
| | A. S. 1059 | 3904 | 5568 | 1664 | 43 |
| E | A. S. 818 | 5000 | 8288 | 3288 | 66 |
| | A. S. 2157 | 5104 | 8144 | 3040 | 59 |
| | A. S. 809 | 4992 | 7878 | 2886 | 58 |
| | A. S. 1195 | 4760 | 7424 | 2664 | 56 |
| F | A. S. 841 | 4068 | 6720 | 2652 | 65 |
| | M. S. 1690 | 4208 | 6424 | 2216 | 53 |
| | M. S. 1638 | 4216 | 6200 | 1984 | 47 |
| | A. S 389 | 3872 | 5664 | 1792 | 46 |

**Height of Plant.** From the experiment laid out in 1928 and described earlier in this paper, the border rows were observed to be significantly taller than the inner rows, the increase going up to 5 per cent.

**Summary.** In irrigated plots, with space between, only the extreme rows on either side constitute the "borders." In grain yield, the weight of an earhead per plant and straw yield, the borders manifest a clear excess of vigour over the inner rows. The increase of a border row over a centre row in earhead yield varies from 47 per cent to 114 per cent, but it is less variable in straw being 27 per cent to 66 per cent. There is evidence of a significant interaction between position and variety for each of the above factors. The height of plants in the border show a slight but significant increase over those in the interior of a plot. By how much the border excels an inner row in yield is not dependent on the size of the plot.

Since bulk crops are practically all "centre" with negligible "borders", it is the yield of the centre that counts. In strip trials under irrigation the borders are an appreciable part relatively to centres. It is found that the borders could differentialy be affected and react on the centres. It is therefore recommended in all such experimental plots the border rows may preferably be excluded.

**Border Effect in Irrigated Sorghum**

**APPENDIX I Average measurements per plant in each line.**

A. S. 795. Yellow grain.

| Plot No. | No. of lines per plot. | W. H. S. | Line Number. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 1 | 1 | W | 82·5 | | | | | | | | | | |
| | | H | 215 | | | | | | | | | | |
| | | S | 11 | | | | | | | | | | |
| 2 | 2 | W | 58 8 | 58·4 | | | | | | | | | |
| | | H | 206 | 219 | | | | | | | | | |
| | | S | 10 | 10 | | | | | | | | | |
| 3 | 3 | W | 62·2 | 40·5 | 45·2 | | | | | | | | |
| | | H | 214 | 203 | 211 | | | | | | | | |
| | | S | 9 | 6 | 7 | | | | | | | | |
| 4 | 4 | W | 51·8 | 31·3 | 41·3 | 51 5 | | | | | | | |
| | | H | 212 | 211 | 211 | 200 | | | | | | | |
| | | S | 8 | 5 | 6 | 8 | | | | | | | |
| 5 | 5 | W | 55·0 | 36·6 | 30·7 | 46·8 | 53·8 | | | | | | |
| | | H | 205 | 211 | 210 | 224 | 230 | | | | | | |
| | | S | 8 | 6 | 5 | 7 | 9 | | | | | | |
| 6 | 6 | W | 66·2 | 32·0 | 38·3 | 37·4 | 35·3 | 49 8 | | | | | |
| | | H | 228 | 222 | 227 | 235 | 222 | 235 | | | | | |
| | | S | 9 | 5 | 6 | 7 | 6 | 10 | | | | | |
| 7 | 7 | W | 58 3 | 33·8 | 43 3 | 39 3 | 40 3 | 45·6 | 53·7 | | | | |
| | | H | 229 | 223 | 233 | 240 | 232 | 239 | 235 | | | | |
| | | S | 10 | 7 | 7 | 7 | 6 | 8 | 10 | | | | |
| 8 | 8 | W | 53·8 | 32·1 | 38·0 | 30·3 | 37·8 | 34 9 | 38 1 | 59·1 | | | |
| | | H | 236 | 233 | 232 | 221 | 226 | 229 | 230 | 244 | | | |
| | | S | 11 | 6 | 7 | 5 | 6 | 5 | 6 | 10 | | | |
| 9 | 9 | W | 56 2 | 44 7 | 43·0 | 37·5 | 34·7 | 30·6 | 30·1 | 40 3 | 52·3 | | |
| | | H | 210 | 219 | 223 | 227 | 218 | 220 | 219 | 236 | 242 | | |
| | | S | 8 | 7 | 7 | 6 | 6 | 6 | 7 | 8 | 10 | | |
| 10 | 10 | W | 48·3 | 29·3 | 30·8 | 30·7 | 35·2 | 38·4 | 33·9 | 35·6 | 33·9 | 54·1 | |
| | | H | 210 | 197 | 209 | 211 | 223 | 231 | 239 | 227 | 229 | 240 | |
| | | S | 7 | 4 | 5 | 4 | 5 | 7 | 7 | 6 | 6 | 9 | |
| 11 | 11 | W | 60·9 | 32·7 | 24·7 | 27·9 | 21·1 | 26·7 | 21·0 | 21·5 | 22 5 | 23·3 | 47·6 |
| | | H | 222 | 211 | 209 | 213 | 195 | 217 | 207 | 215 | 198 | 200 | 211 |
| | | S | 8 | 5 | 6 | 6 | 9 | 5 | 5 | 5 | 5 | 5 | 8 |

W–weight of grain in gms., H–height of plant in cms. and S–weight of straw in lbs.

## APPENDIX II

**Average measurements per plant in each line.**

A. S. 1543. White grain.

| Plot No. | No. of lines per plot. | W. H. S. | Line Number. 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | W | 73·1 | | | | | | | | | | |
| | | H | 196 | | | | | | | | | | |
| | | S | 6 | | | | | | | | | | |
| 2 | 2 | W | 64·6 | 64·6 | | | | | | | | | |
| | | H | 208 | 201 | | | | | | | | | |
| | | S | 6 | 6 | | | | | | | | | |
| 3 | 3 | W | 57·4 | 37·0 | 58·4 | | | | | | | | |
| | | H | 205 | 202 | 205 | | | | | | | | |
| | | S | 6 | 4 | 6 | | | | | | | | |
| 4 | 4 | W | 52·5 | 41·2 | 40·7 | 65·3 | | | | | | | |
| | | H | 211 | 206 | 201 | 215 | | | | | | | |
| | | S | 5 | 4 | 4 | 2 | | | | | | | |
| 5 | 5 | W | 62·5 | 37·0 | 45·4 | 39·9 | 57·6 | | | | | | |
| | | H | 217 | 215 | 226 | 212 | 221 | | | | | | |
| | | S | 7 | 5 | 5 | 5 | 8 | | | | | | |
| 6 | 6 | W | 61·0 | 44·6 | 36·7 | 48·5 | 47·4 | 61·9 | | | | | |
| | | H | 229 | 223 | 222 | 232 | 231 | 230 | | | | | |
| | | S | 7 | 6 | 6 | 6 | 6 | 8 | | | | | |
| 7 | 7 | W | 68·5 | 49·9 | 48·4 | 45·0 | 44·6 | 43·1 | 56·8 | | | | |
| | | H | 239 | 236 | 238 | 241 | 234 | 231 | 234 | | | | |
| | | S | 8 | 6 | 6 | 6 | 6 | 6 | 8 | | | | |
| 8 | 8 | W | 75·2 | 48·3 | 51·1 | 38·5 | 44·2 | 43·9 | 38·8 | 51·0 | | | |
| | | H | 247 | 235 | 236 | 232 | 232 | 223 | 211 | 221 | | | |
| | | S | 10 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | | | |
| 9 | 9 | W | 70·3 | 46·9 | 39·4 | 47·1 | 41·7 | 44·2 | 49·6 | 50·9 | 53·6 | | |
| | | H | 231 | 236 | 236 | 230 | 231 | 230 | 241 | 239 | 232 | | |
| | | S | 9 | 7 | 5 | 6 | 6 | 7 | 6 | 7 | 8 | | |
| 10 | 10 | W | 64·8 | 55·3 | 50·6 | 45·1 | 46·7 | 40·3 | 49·6 | 46·6 | 49·9 | 65·2 | |
| | | H | 243 | 241 | 231 | 237 | 239 | 229 | 238 | 246 | 241 | 244 | |
| | | S | 8 | 8 | 7 | 6 | 6 | 5 | 6 | 6 | 7 | 9 | |
| 11 | 11 | W | 73· | 53·9 | 43·8 | 39·7 | 46·7 | 42·3 | 46·9 | 42·9 | 58·8 | 45·5 | 75·1 |
| | | H | 238 | 237 | 229 | 223 | 231 | 232 | 232 | 223 | 225 | 231 | 235 |
| | | S | 10 | 6 | 6 | 5 | 7 | 6 | 6 | 6 | 7 | 7 | 10 |

W-weight of grain in gms., H-height of plant in cms. and S-weight of straw in lbs.

## Literature Cited.

Cole, J. S. and Hallstead, A. L. (1926)—The effect of outside rows on the yields of plots of kafir and milo, at Hays, Kansas. *J. Agri. Res.* 32: 991–1002.

# Tea Cultivation in South India.

BY E. A. STONE

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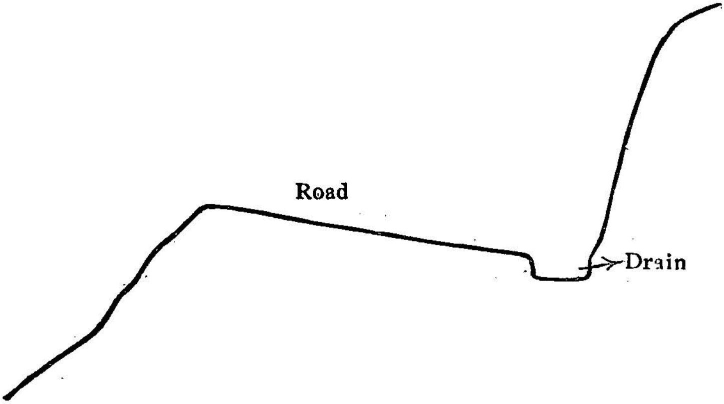
*(Continued from page 91.)*

## NEW CLEARINGS

**Felling.** After the planter has surveyed the area he intends planting, and clearly marked the boundries, the fellers start their work of felling the trees and cutting down the dense undergrowth. This work is done at the beginning of the dry weather i. e. about December and January. In the writer's experience, quite the best people to employ on it are Moplahs. It is a dangerous work except in the hands of experts who know exactly in which direction the tree they are felling will fall, as many of the huge trees are well over 100 feet high and several feet thick at their bases. A couple of months of dry weather is enough for the undergrowth, small trees and bushes, and foliage of the big trees to dry out sufficiently to burn off the clearing. This is done just before the first rains, and a day is chosen when there is not much wind and when what wind there is blowing in the right direction i. e. not towards a neighbour's tea fields. All boundaries adjacent to tea fields must be cleared of branches and undergrowth for twenty yards or more, and neighbours must be warned for miles around, as there is great danger from flying sparks carried by the wind starting fires if they alight on rotten logs or tree stumps.

**Burning.** On the clearing to be burnt off the smaller dried undergrowth is collected into regular heaps, and the igniting coolies then start through in line from one end. If the 'burn off' is a good one it will last for two days or more and there will be little or no 'clearing' to be done afterwards. If early showers or some such reason causes the burn off to be a poor one it will finish in a day, and there will be a lot of expensive clearing, collecting and burning to be done after-wards before it is possible to line the clearing. In any case the big logs are just singed on the outside and remain lying about until they are sawn and chopped up into fuel for the factory tea driers in later years. If by misfortune a strong wind springs up during the burn off and carries fire to neighbouring estates, the planter who started the fire is responsible for any damage done.

**Laying roads.** When the ashes have cooled down sufficiently, roads are traced and lining started. In connection with the former there are a number of elementary commonsense rules to be observed, e. g. roads should only cross at ravines, and a down trace may only change to an up trace at a ravine. This is all connected with water drainage. Then there is the general plan of the rest of the estate to take into acccunt, and where the roads are wanted to lead to. The ordinary estate footpaths are cut 4 or 5 feet wide and should slope inwards to a small road drain as in the accompanying sectional view




Water meeting a blockage of fallen earth or rubbish will flow a course round it and back into the drain on the other side instead of across the road and down the hillside so scourtng away valuable top soil. As a general rule the steeper the hill-side the road is on, the steeper the roads will have to be to cover all the ground for supervision purposes. In tracing a cart road where the main object is to get from one place to another in as short a distance as possible double cuttings through the tops of ridges and embankments across ravines will save distance and cut out many sharp corners which cost a lot in later upkeep. For cart roads gradients should not exceed 1 in 12, but car roads can be traced a lot steeper to save distance. Big deep drains are unnecessary and dangerous to traffic, but as many culverts as possible should be put in to carry off rain water i. e. wherever the road crosses a ravine or hollow. No culvert should be less than 1½ feet square so as to allow for clearing out whereas many must of course be much larger according to the amount of water they may have to cope with. This, all sounds elementary but it is surprising to see the damage caused in the heavy rains through these simple rules being ignored. The roughly opened clearing and the cheaply made road are very definitely cases of 'penny wise and pound foolish' policy.

**Planting.** Tea is usually planted 4' by 4' or 4½' × 3½, which means about 2700 bushes per acre. It is usual to line the rows north and south as the shade from the rows of shade trees usually silver oaks-Grvillea robusta which will be distributed more evenly as 'the sun moves over.' When marking out the lines the direction is of course taken by the compass, and on steep slopes the distances must be plumped, otherwise the lines will become anything but straight. As later on all task work is given by the rows and pluckers pluck also by rows it is very necessary to have them straight and continuous. After the 'king pegs' i. e. the pegs marking the rows have been put in, smaller pegs are put in down the rows to mark the spot where each bush is to be planted. This is done by stretching a long rope between the 'king pegs' which has cloth tags attached at the required intervals. Holes are then dug with crow-bars (*alavangoes*) 1½' deep and

6″ wide at the bottom and these are filled with top soil well pressed down, and the centre of the spot marked with a stick. The clearing is now ready for planting up, which will start as soon as continuous rain is assured.

**Methods of planting.** Plants used may be (a) six month old basket plants, (b) six month old jungle nursery plants transplanted, or (c) 18 month old jungle plants. There is a fourth method of planting out which hardly merits mention and that is seed at stake This is an expedient adopted by the lazy or improvident, who have not troubled themselves to lay out nurseries, and who simply plant the seed out directly in the clearing marking the spot with a stake. The same planter would probably not trouble to have holes dug. If his 'burn off' has been a severe one with resultant loss of humus he is not likely to have much success.

(a) *Six month old baskets.* In planting these out great care must be taken not to shake and lessen the earth in the baskets during transport to the field.

(b) *Six month old jungle nursery plants.* As each plant is removed from the nursery bed with the aid of a 'transplanter' it is carefully shifted from the transplanter into a tin cylinder for transport to the field. The chances of the earth loosening and some falling during transport are so great that this method is not much used.

(c) *Eighteen month old stump plants.* The 18 month old plants which are about 6 or 7 feet high are carefully dug up, the stems cut square across about 3 or 4 inches above the hypocotyls. The main tap root ends are cut off at about 16″ below the hypocotyl and all side roots and 'whiskers' trimmed off. The stumps are then planted out with crow-bars, care being taken to plant at exactly the right depth and to plant firmly. Of the two chief methods of planting some planters prefer "baskets" and some prefer "stumps". Possibly stumps give best results in new clearings, and baskets give better results as 'supplies' for the vacancies in old clearings. After planting, the plants are protected by a ring of stakes or wooden slats or pieces of bark driven into the soil. It is also well worth while to pile a large heap of weeds or jungle growth round about the plant at the beginning of the next dry weather, so keeping the surrounding soil moist and cool throughout the dry weather. Vacancies should be supplied up in the years immediately following planting.

*(To be continued)*

# A Preliminary Investigation on the Efficiency of some Fodders for Milk Production.

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**Introduction.** In India, cattle are kept on the farm principally for work and as producers of butter fat or milk. Their usefulness to the stock-owner is greatly enhanced by judicious feeding. It is well known that the feed of dairy cows includes a maintenance ration to keep them going with a constant body weight and also a production ration depending upon the quality and quantity of milk yield. After supplying as much of the nutrients as possible in the form of roughage to keep the animal " comfortably full ", the remaining ingredients have to be sought for and supplied in the form of 'concentrates'. Feeds and fodders thus together constitute the dairy cow's bill of fare. Though only what is grown on the farm is usually fed to cattle, it is preferable to include in the ration a variety of cattle foods. The Agricultural College Dairy at Coimbatore, adopts the accompanying schedule ration:—

**TABLE I. Schedule of rations for dairy herd at Coimbatore 1934—35.**

| Class | Yield in lbs. | Ground nut cake lbs. | Cotton seeds lbs. | Rice bran lbs. | Dhal husk lbs. | Common salt oz. | Mineral mixture oz. |
|---|---|---|---|---|---|---|---|
| A | 25—30 | 3 | 3 | 2 | 3 | 2 | 2 |
| B | 20—25 | 2½ | 2½ | 2 | 2½ | 2 | 2 |
| C | 15—20 | 2 | 2 | 2 | 2 | 2 | 2 |
| D | 10—15 | 1½ | 1½ | 2 | 1½ | 2 | 2 |
| E | 5--10 | 1½ | 1 | 1 | 1½ | 2 | 2 |
| Price per lb in pies. | | 5·31 | 5.57 | 5·50 | 5·28 | 5·49 | 10·00 |

The ration provides 2 lb. of concentrates for maintenance and an additional 3 lb. of concentrates for every 10 lb. of milk produced. The importance of salt and mineral mixture for the young stock and the lactating cow is too well known. Green succulent fodder is indispensable to milch cows. The palatability of green fodders and their slightly laxative effect make the cow better fitted for her performance. Even if it contains less of nutrients, palatability, it is said, should be an important consideration in the choice of food stuffs. Succulent fodders whet the appetite of the animals with the result that larger amount of roughage is consumed.

It is the desire of the average ryot to substitute as much of the concentrates as possible by roughage and thus bring the cost of milk production down to the minimum without loss of efficiency. It is here that the research worker should tell him what fodder and how much of it should be given to his stock to obtain the maximum benefit.

The growing of crops entirely for the use of the farm stock is not widely practised in India unless it be in Government farms and their necessarily 'infectious' surroundings. What poor little stuff remains in the form of herbage stalk or straw is fed to the animals, and no wonder that the cattle

do not perform their work with efficiency. Many cultivators in this country have yet to realise the immediate necessity for setting apart a portion of their holding for raising fodder crops for their stock.

Among the various crops that are selected as fodders, the cereals and the legumes figure prominently; sorghum (cholam or Jonna) and Indian corn (maize) belong to the former group, while cow-pea and *pillipesara* are leguminous plants. These crops are grown individually or as mixtures as evidenced by the well known sorghum cowpea combination. Mention may be made in this connection of two exotic crops, whose value in the economic feeding of farm stock is being increasingly appreciated. The Guinea grass (*Panicum maximum*) and lucerne (*Medicago sativa*) are now grown in several parts of Madras.

The following table gives the average yields and the cost of cultivation per acre of the three main fodders in the Central Farm, Coimbatore.

**TABLE II Cost of Production of fodders—average of nine years from 1925—34.**

| Fodder | yield per acre in lbs. | cost of cultivation | lbs. per rupee | cost of produciion per lb in pies. |
|---|---|---|---|---|
| Cholam | 18,024 | 48 13 11 | 369 | 0·52 |
| Maize | 14.518 | 56 6 9 | 257 | 0·74 |
| Guinea Grass | 31.737 | 45 8 3 | 697 | 0·27 |

**Nature of the Investigation.** Investigation was started under the auspices of the Madras University in October 1935 to study the effect of some of the fodders with the existing kinds of concentrates on the milk yields of cows at the Agricultural College dairy, Coimbatore. Three different fodders were selected and fed in weighed quantities to the cows continuously for a number of days and from their milk yields it was possible to determine how much feed of each fodder was required to produce one lb. of milk. The possibility of curtailing the quantities of concentrates as a measure of economy by reducing the normal production ration from 3 lbs. of concentrates for every 10 lbs. of milk to 2 lbs. for the same quantity was also investigated.

The reduction of concentrates was made without seriously affecting the nutritive ratio by a careful adjustment of the different kinds of concentrates. The following represents the reduced ration chart:—

**TABLE III. Reduced ration chart.**

| Concentrates | Class A | Class B | Class C | Class D | Class E |
|---|---|---|---|---|---|
| Groundnut cake | 2½ | 2½ | 2 | 1½ | 1½ |
| Cotton seed | 2½ | 2 | 1½ | 1½ | 1 |
| Rice bran | 1½ | 1½ | 1½ | 1 | 1 |
| Dholl husk | 1½ | 1 | 1 | 1 | ½ |
| Total in lbs. | 8 | 7 | 6 | 5 | 4 |

In addition, 2 oz. of salt and 2 oz. of mineral mixture were also supplied in each of the rations. (Mineral mixture is made by intimately mixing equal parts of shell meal and steamed bone meal.)

**Limitations of the Experiment.** The investigation conducted had to be discontinued after a short period. The nature of the experiment is such that it requires longer periods to come to any conclusion and should be conducted on a larger number of animals. Dealing with biological systems, the experimenter on livestock is confronted with considerable difficulty. The trouble begins from the selection of animals which are to be similar in age and condition, yield and lactation, breed and body weight. The continuous supply of fodders and their composition depend largely upon the vagaries of the season and the age of the crop respectively. Ill health and disease of the experimentals will certainly vitiate the results of the experiment. Moreover as the experiment was conducted on cross bred cows, it cannot be said with much certainty what would be the effect of these fodders on the indigenous type of animals.

**Experimental details.** Six cross-bred cows fairly similar in age, yield and lactation were selected for the experiment. Although five cows were in their fifth lactation one was in its second. They were divided into three lots of two cows each. Three green fodders were selected :—

1. Fodder maize
2. Fodder Cholam

and 3. Guinea grass.

These were fed as much as each animal would eat. And the quantities were fixed by a week's feeding trial prior to the actual expriment at 55 lbs. for Guinea grass and fodder cholam, and 60 lbs for fodder maize, which included some quantity left as residue. Each treatment in each lot lasted for 31 days of which the first 10 days were considered as pre-treatment periods to allow the animals to get accustomed to the changed ration and the next 21 days alone being counted as experimental period. A summary of different treatments is given below.

**TABLE IV. Treatments.**

| Lot | Cow No. | October. | November. | December. |
|---|---|---|---|---|
| 1 | 258 & 319 | Guinea grass and full concentrates | Guinea grass and full concentrates | Guinea grass and full concentrates |
| 2 | 250 & 265 | Guinea grass and reduced concentrates | Fodder maize and full concentrates | Fodder maize and reduced concentrates |
| 3 | 263 & 252 | Fodder cholam and full concentrates | Fodder maize and reduced concentrates | Fodder maize and full concentrates |

Lot 1 received guinea grass and full concentrates during the three months, which were treated as 'controls'. The treatment viz., fodder cholam and reduced concentrates could not be continued in November or December as by then the whole crop had been off the field. In November and December the "reversal" method was adopted between lot 2 and 3. The concentrates were altered and fed according to the milk yield once in every fifteen days.

**Discussion of Results.** Three lots of animals were put on different fodders and different quantities of concentrates. From the exact quantities of fodder and the concentrates consumed by the different lots during each of the three months of experimentation and the quantities of milk yielded by three lots in the corresponding periods, the quantities of fodder, utilised in the production of one pound of milk were calculated. The cost of fodder and the cost of concentrates per pound of milk were also worked out.

**TABLE V. Treatments and yield.**

| | October. | | | November. | | | December. | | |
|---|---|---|---|---|---|---|---|---|---|
| Lot | Fodder consumed lbs. | Milk yield lbs. | Cost of conc. in pies. | Fodder consumed lbs. | Milk yield lbs. | Cost of conc. in pies. | Fodder consumed lbs. | Milk yield lbs. | Cost of conc. in pies. |
| 1 | 2173 | 1139¼ | 2198·20 | 2226 | 1092½ | 2327·48 | 2216 | 1038¼ | 2157·50 |
| 2 | 2215 | 864½ | 1364·18 | 2243 | 872¼ | 1988·12 | 2465 | 663½ | 1255·53 |
| 3 | 2166 | 873¾ | 1899·24 | 2480 | 784½ | 1369·77 | 2454 | 688½ | 1648·76 |

| | October. | | | November | | | December | | |
|---|---|---|---|---|---|---|---|---|---|
| Lot. | Treatment | Cost of fodder pies. | Cost of conc. pies. | Treatment | Cost of fodder pies. | Cost of conc pies. | Treatment | Cost of fodder pies. | Cost of conc. pies. |
| 1. | G. Grass & full conc. | 0·51 | 1·928 | G. grass & full conc. | 0·55 | 2·143 | G. grass & full conc. | 0·58 | 2·048 |
| 2. | G. grass & reduced conc. | 0·69 | 1·578 | Fodder maize & full conc. | 2·06 | 2·280 | Maize & reduced conc. | 2·77 | 1·905 |
| 3. | Cholam | 1·29 | 2·170 | Maize & reduced conc. | 2·35 | 1·745 | Maize & full conc. | 2·65 | 2·413 |

In 93 days, we have the data from three sets of experiments each of 21 days' duration the first ten days being considered pretreatment period. Though in fact nine treatments were carried out in three lots of animals in three in instalments, there are only five different treatments, others being only repetitions. The following table represents the 5 different treatments, the average quantities of fodder used up in production, their cost and the cost of production of one pound of milk.

**TABLE VI. Treatments and cost.**

| Treatment | No. of repetition | Quantity of fodder per lb. of milk. | Cost of fodder per lb. of milk in pies. | Cost of conc. per lb. of milk in pies. | Cost of production of a lb. of milk | percentage cost of fodder. |
|---|---|---|---|---|---|---|
| G. gr. & full conc. | 3 | 2·02 | 0·553 | 2·048 | 2·601 | 21·3 |
| G. gr. & reduced conc. | 1 | 2·56 | 0·701 | 1·578 | 2·279 | 30·8 |
| F. ch. & full conc. | 1 | 2·48 | 1·289 | 2·170 | 3·459 | 37·3 |
| F. Mze & full conc. | 2 | 3·18 | 2·365 | 2·346 | 4·711 | 50·2 |
| F. Mze. & reduced conc | 2 | 3·45 | 2·566 | 1·825 | 4·391 | 58·4 |

Taking Guinea grass as the standard of comparison, and 100% efficient the fodders and their treatments can be rearranged according to their efficiencies in the following order.

**TABLE VII. Treatments and their efficiency.**

| Treatment | Quantity of fodder per lb. of milk. | Efficiency of fodder. |
|---|---|---|
| G. grass & full conc. | 2·02 | 100 |
| F. cholam & full conc. | 2 48 | 81 |
| G. grass & reduced conc. | 2·56 | 79 |
| F. maize & full conc. | 3·18 | 64 |
| F. maize & reduced conc. | 3 45 | 59 |

It is by no means presumed that these different fodders are capable of their performance individually, but can be said to do so only in conjunction with the particular kind of concentrates. The above table reveals that though there is a corresponding decrease in the cost of concentrates per lb. of milk, when the concentrates are reduced in the production ration by a third of its normal ration, the quantity of fodder used up per lb. in production of one pound of milk increased slightly, but not to such an extent as to make the reduction of concentrates on the whole uneconomical as evidenced by the cost of production of a pound of milk. In the following table, the savings in the cost of concentrates by reducing the normal ration to two thirds of that followed in the dairy, has been worked out:—

**TABLE VIII. Saving in cost.**

| Class | cost of concentrates in pies (normal ratio) | Cost of concentrates in pies (reduced ratio) | Saving in the cost of concentrates in by difference | Percentage saving in cost |
|---|---|---|---|---|
| A | 55·416 | 40·806 | 14·610 | 26·4 |
| B | 47·336 | 35·381 | 11·955 | 25·3 |
| C | 39·256 | 29·941 | 9·315 | 23·9 |
| D | 31·176 | 26·036 | 5·140 | 16·5 |
| E | 25·891 | 20·611 | 5·280 | 20·4 |

The milk yield and the live weights of the experimentals have formed the basis of the inference. It has been noticed that there was a gradual fall both in milk production and the weight of the cows.

Average weekly live weights of the cows.

**TABLE IX.**

| Cow No. | October. 1st week | 2nd week | 3rd week | 4th week | November. 1st week | 2nd week | 3rd week | 4th week | December. 1st week | 2nd week | 3rd week | 4th week |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 258 | 1020 | 996 | 981 | 981 | 968 | 968 | 972 | 981 | 971 | 980 | 972 | 1000 |
| 319 | 1064 | 980 | 996 | 992 | 984 | 960 | 978 | 965 | 976 | 992 | 1012 | 1056 |
| 250 | 932 | 904 | 884 | 844 | 844 | 864 | 817 | 850 | 861 | 872 | 856 | 868 |
| 265 | 836 | 824 | 778 | 748 | 748 | 776 | 701 | 721 | 739 | 776 | 764 | 784 |
| 263 | 1020 | 1064 | 1032 | 992 | 1036 | 980 | 1044 | 1049 | 1016 | 1028 | 1032 | 1040 |
| 252 | 1036 | 1049 | 1013 | 1000 | 960 | 948 | 972 | 992 | 980 | 972 | 992 | 1100 |

But as this was found to happen in all and not confined to one particular lot or treatment, it is not reasonable to say anything against any particular fodder or treatment including the reduction of concentrates. It is quite possible that the lactations and the seasons had their share in lowering the milk yield and weights of the animals. However investigations of this sort can be precise only if continued for longer time and over larger number of cows in many lactations..

**Summary.** Six cross bred cows were experimented upon to study the effect of three fodders grown at the Central Farm Coimbatore, on the milk yield of cows at the Agricultural college dairy. They were divided into three lots, each lot being given varying treatments of fodder and concentrates. The following indications are observed :—

A. Basing on the quantities of fodders used up by cows for milk production the three fodders studied may be arranged in the decending order of their efficiency as guinea grass, fodder cholam and fodder maize.

B. when the concentrates are reduced from the full ration a slight increase occurs in the quantity of fodder consumed but the cost of this incrcase is negligible when compared to the saving effected by decreasing the concentrates.

C. A reduction of a third of the quantity of concentrates in the production ration of the cows is possible, justifiable and economical.

**Acknowledgement.** The author's grateful thanks are due to R. C. Broadfoot Esq., Principal, Agricultural College, Coimbatore for granting permission to work in the college dairy and to Sri K. Raghavachariar, Lecturer in Agriculture for guiding the work with timely suggestions.

Sri V. Karunakaran Nair and M. Alagiriswami, the Dairy managers, had been of great help to me and their help is gratefully acknowledged.

## The Hairy Caterpillar Pests of S. India.

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Among insect pests of economic importance all over the world the creatures known as hairy caterpillars not only possess a very high degree of importance, but are also very well known to all cultivators. Such forms as the gipsy moth, the tussock moths, the web worm, tent caterpillars, brown tail moths, tiger moths etc., are some of the notorious members of this category of insects in different parts of Europe and America. Of the many species of hairy caterpillars found in South India and known under different local names such as *Kambli poochi* (tamil), *Kambli puzhu* (malayalam), *Gongali purugu* (telegu), *Kambli hula* (kanarese), etc., we have about two dozen forms possessing different degrees of economic importance and attacking a variety of cultivated plants. A brief account of the general features, economic importance and possible methods of control, is given below.

**General Organisation and Bionomics.** These caterpillars are larval forms of different kinds of moths. They are more or less cylindrical creatures worm-like and clothed with hairs. In length they range from an inch in the smaller species to three or four inches in the case of giants among them; they are usually elongated and more or less of uniform build from head to tail except at the thoracic region in some, and in many cases depressed along the median dorsal region. In most of them the head is hemispherical and the thoracic legs and the ten abdominal pro-legs are generally distinct.

The clothing of hair varies a great deal. In some the covering is sparse as in the *Syntomidae*, in others the body is closely covered often with the hairs long or short and closely arranged in tufts rising from fleshy tubercles and in-transverse rows on the body as in *Arctiidae* and *Eupterotidae*., and in some others the hairs on some regions of the body, especially the head and throax, are differentiated into long tufts, elearly marked off from the hairs of the other regions as in *tussock worms* (Lymantridae) or arranged in closely packed brushlike pattern often in different cryptic colors as in *Lasiocampid* larvae. The hairy clothing in some of these forms is often found mixed up with sharp setae and poisonous nettling hairs very irritating to the touch. This hairy protection arranged in different patterns is evidently helpful in keeping away many a bird or reptile enemy. Though there are a few individual variations in some forms, all these caterpillars behave more or less in the same manner and their life history and habits are similar in many respects. They are mostly surface forms and feed exposed without any special protective contrivances as is generally found in many leaf rolling, shoot folding or boring caterpillars, though a few like the sunn hemp caterpillar thrust their heads into seed pods. Some of them, especially the *Eupterotids* as in the case of the moringa caterpillar feed gregariously in hundreds together so that the plant surface becomes uniformly covered with a blanket-like woolly covering of live caterpillars. These caterpillars also possess the usual habit, like most moth larvae, of hanging themselves on silk strands and getting widely distributed on the food plant. They move about actively and some of them temporarily curl up when disturbed, like millepedes. In the case of some like the notorious red hairy caterpillar of groundnut (*Amsacta albistriga*) swarms of them regularly march from field to field like locusts or army worms, regardless of the dangers and impediments, feeding on almost everything green and leaving behind them a trail of defoliated or skeletonised plants. We find these plagues occasionally blocking foot paths and public roads near fields. Some years ago a swarm of these actually stopped and delayed a railway train in the S. Arcot district ; they marched along the track in enormous numbers and covered the railway road for a fairly good distance ; their crushed bodies made the rails so slippery that the engine could not get traction, with the result that the train had to stop and was able to proceed only after the rails were completely cleared of these creatures. Some of these creatures can become a domestic nuisance in some areas ; the red hairy caterpillar plague often enters huts and dwellings in the proximity of groundnut fields and causes disturbance and affects children who often come into contact with them unknowingly. In the submontane tracts along the Western ghats the lichen and moss feeding dark brown hairy form (*Asura conferta*) invades houses and becomes a regular nuisance in various ways during the post-monsoon months (August-November). The nature of the irritation and discomfort casued to our bodies by coming into contact with them vary with different species and with the varying constitution of the persons affected ; in some persons the touch of the moringa

caterpillar (*Eupterote*) or the Wooly bear of ragi (*Amsacta lactinea*) or the Babul lasiocampid (*Metanastria*) causes not only wide spread irritation but also gives rise to eruptions on the body as in the case of nettling and poisonous plants.

**Life history.** There is nothing very peculiar or striking in the life histories of these creatures, and very few variations are found. Each moth lays a number of eggs ranging from 20 or 30 to as many as a thousand and these are generally deposited in massess or clusters, each mass being covered over by a felted hairy covering. The young ones hatching out of these eggs move about often in company and feed on the green matter of their respective food plants. As they grow and moult they separate and when full fed pupate. Pupation is either on the plant itself or in some cases in the soil ; in the former case the pupa is found enclosed in a hairy cocoon made of silk and frass and in the latter case the creature goes two or more inches below the soil and pupates inside an oval earthen coccon. The incubation period of the pupa varies in different species ; some of them, especially the notorious red hairy caterpillar (*Amsacta albistriga*) remains underground in the pupa stage from September or October to the following June or July. Thus the number of generations per year would vary, since the pupation period varies from a fortnight or two in some to eight or nine months in others. The adults of hairy caterpillars are moths of varying colors and sizes ; some are small and sombre while others have expansive wings and display varying colors, often with spots, or patches in attractive tints. Many moths exhibit an attraction to lights (Phototropism) and hundreds are often found hovering about street lights and household lamps. The moth of the domestic hairy caterpillar (*Asura*) noted above displays this tropism in a pronounced degree. Though the adult moths are winged in most species, some forms of female moths are wingless, e. g. the castor tussock (*Orgyia postica*). The female in such cases appears as a mass of flesh with legs and rarely moves from the place of emergence. The life of the adults is as usual short and mating of the sexes takes place within a day or two ; soon after mating or egglaying the parents die.

**Economic importance.** While some are extremely important as serious crop pests others are either of minor importance or only occur occasionally as sporadic local plagues. There are very few commonly cultivated plants which escape the attentions of one or more of these hairy creatures. The tabular statement below gives briefly the name, group, food plants, status and other information worthy of note of the forms so far noted from S. India, which are associated with cultivated plants. However, a few words on some of the important species among them call for some special attention on the part of agriculturists. The most important of these economic forms in S. India is the Red hairy caterpillar (*Amsacta albistriga*, M.). While it is almost omnivorous in food habits it exhibits a special liking to dry crops like groundnut, *cumbu*, sorghum and pulses. The wide spread extension of groundnut cultivation throughout the presidency within the past decade or two has helped this insect to distribute itself widely in the different tracts

of the province; until a few years ago it was a pest only in parts of the coromandal coast districts of S. Arcot, Chingleput etc.; but now we have it in the N. Circars, Mysore and Ceded districts, not to speak of its activities in the southern areas of Madura, Tinnevelly and Ramnad districts. This insect is found specially partial to red soil areas but so far it has not attracted the attention of the cultivator along the West coast tracts. Between this pest and most of the other members of this hairy group of the plains there is a very wide gulf, since not one of the latter has approached it either in its wide distribution or in the extent of damage caused, and we have had hardly any report of a very serious nature about any of the other species of this group. The tussock caterpillars of Castor, Gogu, Paddy, Mango, etc. spp. *Euproctis, Psalis* etc. and the wooly bear caterpillar of ragi, pulses etc. (*Amsacta lactinia*) may be ranked next; the wooly bear is generally found on ragi, pulses etc. but is not a regular pest like the red hairy caterpillar. It is recorded as a serious pest in Gujarat. The castor plant often suffers badly from species of *Euproctis* and *Orgyia*. The hairy caterpillars on the sunn hemp plant (spp. of *Utetheisa* and *Argina*) also become occasionally serious in parts of the Northern Circars and the Southern districts of Ramnad and Tinnevelly. Castor and Banana suffer sometimes badly from sporadic attacks of the dark brown hairy caterpillar (*Pericallia ricini*). The yellow and dark hairy caterpillar (*Diacrisia obliqua*) which is a well known pest in N. India and called the Behar hairy caterpillar by authors, though found in S. India, is not so destructive or widely distributed. It is generally noted in the submontane areas along the west coast and is chiefly a feeder on wild plants, like lantana, mimosa etc., though occasionally noted also on sweet potato and wild convolvulaceae in Malabar. The blanket caterpillar (*Eupterote mollifera*) is a well distributed creature and is found on the moringa tree all over the province often found covering the main stems and branches in hundreds. The zyzyphus hairy larva (*Thiacidas postica*) with its pale brown body covered with long pale whitish hairs has also this gregarious habit and is well distributed in the dry districts. The occasional sight of the complete skeletonising of large ficus trees (Banyan, Peepul etc.) along some of our roadside avenues and meadows is caused by the grey red headed ficus hairy caterpillar (*Hypsa ficus*); similarly the Ailanthus tree is also found completely defoliated often by the hairy caterpillar (*Eligma narcissus*) in parts of Coimbatore and Salem districts. Within the past two or three years I have also come to know of serious outbreaks of a hairy caterpillar pest in the Cardamom plantations along the Western ghats, especially in parts of Coorg. So far as I could make out the insect appears to be allied to the moringa caterpillar and is probably a species of Eupterote (*E. Canaraica*, M.) previously noted from the ghat regions of Mysore.

**Control.** Methods of control against hairy caterpillars attacking cultivated crops depend mainly on the life habits of each species concerned, the extent and nature of the damage caused by it and the local conditions. Some minor pests like the Paddy hairy caterpillar (*Psalis securis*), the sweet potato syntomid (*Euchromia polymena L.*) or the ficus tussock (*Perina

*nuda F.*) etc. do not generally demand any serious attention. Advantage should be taken of such habits as egg laying in masses, gregarious feeding, pupating underground or in masses on the food plant, attraction to lights, or special traps etc.—so that the pest can be checked effectively and economically by tackling them at such stages. Handpicking and destruction of the first emerging moths and egg clusters, collection and destruction of gregariously feeding larvae, trapping of phototropic moths by means of light traps, ploughing up the soil of a badly infested field to destroy the underground pupae to check future generation—all these are methods which will prove effective and very practicable. When such feasible methods are not adopted at the proper time and the pest allowed to increase and the caterpillars become a plague it will be found very difficult, expensive and even impossible in some cases to check them. Of course to resort to these timely and suitable measures the cultivator has to get some acquaintance with the main points in the life history and habits of these pests in his tract; it is evident from this how important and helpful it will be for every cultivator to get some general knowledge of his crop pests. In the case of the Red hairy caterpillar the following were the chief instructions given to cultivators in badly infested areas and these might be followed in all such cases. (1) During the three or four days after each good shower in May—June even little boys may be employed to hand pick the moths which appear late in the evenings in the fields that were badly infested the previous season. Each boy will be able to collect hundreds and these can be killed easily by crushing or burying them deep. The moths are very inactive at this time. (2) Keep light traps at dusk. These lights will attract numbers of moths and they can also be killed easily. The destruction of one moth is equal to the destruction of 800 or 1000 caterpillars and so this is the best method of control for the pest. Those fields that were badly infested the previous season may also be ploughed in summer to bring up the underground pupae. In some fields they might be found in heaps of thousands and in one or two cases several bushels of these date seed like pupae were collected. These can be crushed or exposed when birds destroy them quickly. Spraying, dusting, or trapping with chemicals, though effective may not be found practicable propositions in this country at present, not only from the point of view of economy, but also from the point of view of risks attending the use of poisons. In India insecticides and spraying machines can only be suggested for ordinary field crops when cheap local insecticides and applicances become easily available and when the standard of literacy of our average farmer improves. In the case of serious plagues of these caterpillars when they often move from field to field in swarms the progress of the moving hordes can be checked by digging trenches and entrapping them and isolating the uninfested area. The frequent attacks of the red hairy caterpillar in parts of S. India during the past decades had become so serious that government had to resort to legislative measures in connection with this pest, and a pest act is enforced during certain months of the year (generally from June to October) in

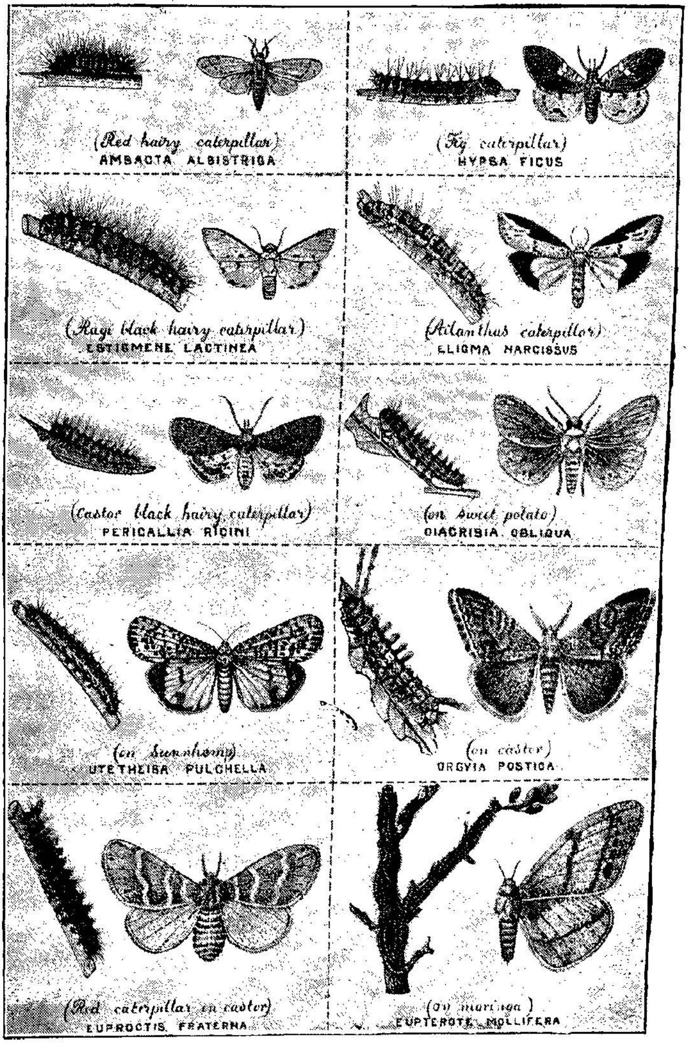
notoriously infested areas, and cultivators are compelled to carry out certain stipulated measures chiefly those noted above, to control the pest. No other caterpillar has become such a serious pest in S. India till now.

Though some of these caterpillars are subject to the attacks of hymenopterous and tachinid parasites and sometimes to bacterial diseases, we have not as yet secured sufficient data or material as regards their natural enemies and their possibilities for utilising them in the biological control of these pests.

*** Some South Indian Hairy Caterpillars of Economic Importance.**

| Popular and Scientific Name. | General form of moth and caterpillar. | Chief food plant. | Remarks. |
|---|---|---|---|
| **Family Arctiidae** | | | |
| Red hairy caterpillar *Amsacta albistriga*, W. | Moth with whitish brown wings and the abdomen with red bands. Caterpillar brown to reddish with dark markings. | Ground-nut, millets, pulses. | The most serious of all the South Indian forms (pupates under-ground). |
| The black wooly bear *Estigmene lactinea*, H. | Moth beautifully white with pink and dark markings. Caterpillars black and profusely hairy moving like a bear. | Millets and pulses. | Not a regular pest though serious when sporadic. |
| Black castor hairy caterpillar *Pericallia ricini*, F. | Moth—upper wings greyish brown, lower wings reddish with dark patches. Caterpillar dark grey well covered with hairs. | Castor, banana and pulses. | Sometimes bad on castor and garden crops. |
| Sunn hemp hairy caterpillar *Utetheisa pulchella*, L. | Moth—upper wings spotted with red and black, lower wings pale white with dark patches along margin. Caterpillar dark with red and white markings. | Sann hemp. | Often serious on sunn hemp; moth flies during the day. |
| Behar hairy caterpillar *Diacrisia obliqua*, W. | Wings pale yellowish with isolated dark spots, abdomen orange and spotted. Caterpillar stout pale brown with yellowish cross bands and profusely hairy. | Sweet potato Lantana. | A serious pest on various crops in parts of North India |
| The household hairy caterpillar *Asura conferta*, W. | Small orange coloured moth with dark patches on forewings and along margin of hind wings. Caterpillar small dark with orange spots and very hairy. | Feeds on lichen, moss etc., on walls of houses, tiles etc, is a domestic pest. | Often a nuisance in houses in villages near ghats during the rains. |
| Small cholam earhead hairy larva *Celama internella*, W. | Small pale white moth. Small greyish caterpillar. | On cholam ears and mango leaves. | Of minor importance. |

* There are also found a few caterpillars which are more or less hairy among Microlepidoptera and other moth families but only the more conspicuous of these having any economic importance are included here.




Some South Indian Hairy Caterpillars.

| Popular and Scientific Name. | General form of moth and caterpillar. | Chief food plant. | Remarks. |
|---|---|---|---|
| **Family Lymantriidae** | | | |
| Red Tussock caterpillar *Euproctis fraterna*, M. | Yellow winged moth. Caterpillar dark brownish red with tussock hairs on head. | Castor, red gram, cotton, rose | Sometimes sporadic on castor, cotton etc. |
| Yellow striped tussock caterpillar *Euproctis scintillans*, E. | Moth like *E. fraterna* but the wings with bigger pale patches. Caterpillar similar to *E. fraterna* but with a longitudinal dorsal yellow stripe. | Mango, gogu etc. | Rarely serious. |
| Castor tussock *Orgyia postica*, W. | Female wingless, male small dark brown moth. Caterpillar brownish with tussock hairs. | Castor. | Often serious on castor, pupates on the plant. |
| Babul Tussock *Euproctis lunata*, W. | A small yellowish white moth. Small greyish caterpillar. | Acacia arabica (Babul) | Sometimes very bad on the babul tree. |
| Paddy yellow hairy caterpillar *Psalis securis*, Hb. | Pale grass yellow moth forewings yellowish. Caterpillar with red and dark markings and long tufts of hairs. | Paddy, grasses. | Very rarely serious. |
| Fig Tussock caterpillar *Perina nuda*, F. | Male forewing hyaline, female pale yellowish. Greyish green larva with tufts of hair on all sides. | *Ficus* spp., Jak. | A minor pest. |
| Zyzyphus hairy caterpillar *Thiacidas postica*, W. | Upper wings greyish lower ones pale white. Pale greyish larvae with close covering of long hairs. | Ber (Zyzyphus jujuba). | Sometimes found in hundreds on the food plant. |
| Tea hairy caterpillar *Dasychira horsefieldi*, S. | Grey coloured moth. Grey larvae. | Tea. | Sometimes sporadic in tea areas. |
| Tea and Castor tussock *Olene mendosa*, H. | Brownish moth. Caterpillar is like that of *D. horsefieldi*, S. | Castor, red gram. | Do. |
| **Family Hypsidae** | | | |
| Ficus hairy caterpillar *Hypsa ficus*, F. | Pale yellowish moth with yellow and black markings at base of forewing. Caterpillar dark brown with white, yellow and reddish markings. | *Ficus* spp. | Sometimes very serious on Ficus trees. |
| Sunn hemp hairy caterpillar of orange moth *Argina cribraria*, C. | Wings orange coloured and with dark spots. Caterpillar like that of *Utetheisa pulchella*. | Sunn hemp. | Occasionally bad. |
| Sunn hemp caterpillar of crimson moth *Agrina syringa*, C. | Caterpillar like that of *Utetheisa pulchella*. | Do. | Do. |
| **Family Lasiocampidae** | | | |
| Babul hairy caterpillar *Metanastria hyrtaca*, C. | A large grey brown moth with shady patches on wings. Long grey larva fully covered with poisonous hairs. | Babul, Parijath (Nyctanthes). | Rarely serious. |

| Popular and Scientific Name. | General form of moth and catterpillar. | Chief food plant. | Remarks. |
|---|---|---|---|
| **Family Eupterotidae** | | | |
| Moringa hairy caterpillar *Eupterote mollifera*, W. | Large pale yellowish moth. Long greyish caterpillar with irritating hairs. | Moringa. | Often found on this tree in thousands. |
| Paddy Eupterotid *Nisaga simplex*, W. | Brownish yellow with dark markings on wings. Blackish caterpillar with yellow markings. | Paddy. | Found occasionally in some numbers in Ganjam district. |
| Cardamom hairy caterpillar *Eupterote canaraica*, M. | A reddish brown moth. Pale brown hairy caterpillar. | Cardamom. | Found in thousands on cardamom and other low growing crops chiefly in Coorg and parts of the western ghats. |
| **Family Saturniidae** | | | |
| The wild silkworm *Cricula trifenestrata*, H. | Large pale brown moth with eye like spots on all wings. Dark brown caterpillar covered with tufts of hairs which are poisonous and irritating. | Cashew and mango. | Cocoon of hairs and silk, golden yellow and found in masses on the tree; the caterpillars feed together in numbers. |
| **Family Syntomidae** | | | |
| The sweet potato syntomid *Euchromia polymena*, L. | Dark moth with orange spots on wings and red bands on abdomen. Caterpillar not very hairy. | Sweet potato. | Sometimes serious on sweet potato in Travancore. |
| **Family Noctuidae** | | | |
| Ailanthus hairy caterpillar *Bligma narcissus*, C. | A large beautiful moth yellowish with pale and dark stripes on wing. Long larva with red and black bands and yellowish head and covered with slender hairs. | *Ailanthus excelsa* an ornamental tree in Coimbatore area. | Found often in numbers on the tree. Pupa also on tree stem inside a pale silken cocoon. |
| Bringal leaf folder. *Eublemma olivacea*, W. | Olive green in colour with hind wings alone pale whitish. Medium sized caterpillar violet brown with yellow spots and hairy. | Brinjal. | Sometimes bad on brinjal as a leaf folding pest. |
| Brinjal hairy caterpillar. *Cryptothrips occulta*, S. | A small grey brown moth. Small caterpillar very hairy and with long yellow streak along dorsal side. | Brinjal. | Often very bad on brinjal foliage, especially in Malabar. Feeds gregariously. |

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## SELECTED ARTICLE

# The Collective Farm System in Russia.

By Dr. HAROLD H. MANN

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The story of co-operation in Russia has been different, both in its history and in the final form which it has now reached, from anything that has happened, in any other country in the world. It began about the end of the last century on lines similar to those in other countries and although it was distrusted by the Government of Imperial Russia, yet it developed very rapidly. Before the great world war the Co-operative societies numbered at least 27,000 chiefly for the supply of agricultural credit. The Communist Revolution in 1917, destroyed almost the whole of the previous structure, specially so far as credit societies were concerned and what was left became for the time being practically a State Department.

A reaction took place in 1921 with the re-creation of the Co-operative movement. So far as agricultural co-operative societies were concerned at this period the members were individual peasants, and they were very largely used for the purpose of combined purchase or combined sale. In the palmiest days of the 'New Economic Policy', as it was called, the number of members of such societies became over eleven millions or about half the peasant population of the country.

A new epoch, however, opened in 1928, and since that time while ordinary co-operation, as we have known it elsewhere has tended to decline, the organisation of communal agriculture has gone further than in any part of the world and been conducted on co-operative lines. The extent to which other forms of co-operative work have declined can be judged by the abolition of the urban consumers' movement in 1935—a form of co-operation which, when I first went to Russia in 1930, seemed universal and seemed likely to absorb all shop-keeping in the country.

But rural co-operation, centered round the collective farm, has developed marvellously, though with many changes of policy, many setbacks, and at one stage a narrowly avoided collapse, till it has become almost universal, either in the form of the collective farms themselves or in the rural consumers' movement which acts as a buyer of agricultural produce. In the present article I will limit myself to an account of the organisation and working of the collective farms themselves both as recorded in published reports, and also as I have seen it myself in the country.

It is well known that the ownership of land in Russia has been in some sense communal throughout the whole of history. It was only in the second half of the 19th century that the idea of peasant ownership came in the front. This being the case the transformation to a collective system, though full of difficulty was not nearly so revolutionary as it would be, for example, in India, where individual possession of land has very long history and is very deep-seated in the minds of the rural population. All the same, one of the first results of the communist Revolution in 1917 was the seizure of almost the whole of the agricultural land by the peasants. The large estates of the landlords were split up and, in spite of Communist theory, it looked as if the whole land would become a mass of

individual peasant holdings, though of course the community as represented by the State, demanded a much greater share in the produce than the State had ever taken before.

This continued, as I have already said, until 1928, when a genuine attempt was made to reconvert the mass of individual holdings in a village or similar area, into a communal holding. At this time however, there were a good many different views as to what the nature of the communal holding should be, how far it should go in taking account of all the possessions of each peasant, how far the area should be treated as one and also how far the management should be unified. There were some, in fact who wished that everything possessed by the peasants should be communalised, that is to say, should be treated as belonging not to individuals but to the community as a whole Some went so far as to consider that no peasant should hold individually even his house, his poultry or a milking cow. There was a time when it appeared as if this view was likely to dominate the situation but it was always resisted by the peasants over the greater part of the country, and the result of attempts to enforce it led to the slaughter of a very large proportion of the livestock in the country in 1932 and the early part of 1933, I fancy indeed that the whole of Soviet system came more nearly to a breakdown at this time than any other period of its history, largely owing to the resistance of the peasants to the complete collectivisation of property which was demanded.

As has so often happened during the re-organisation of Russia since the Revolution, the authorities realised the dangerous position of things in the early part of 1933, and a very famous decision was made at this time largely under the inspiration of Stalin whereby individual ownership was recognised over a very large part of a peasant's possessions. He was encouraged to have a milking cow of his own; to possess chickens and small animals of similar kind; to have a cottage and surrounding garden which belonged to himself; while at the same time the general agriculture of each collective unit continued to be run on a communal basis. The result is that at the present time it is estimated that four per cent of the rural land in Russia (1935) form the private gardens and other lands belonging individually, to the members of collective farms.

From 1933 the organisation has become fairly stable, and I think it may be said that the collective farm system of Russia is now well understood by the peasants, and works (at any rate in a fairly successful season) with no more friction or trouble than is the case with the agricultural organisation of a more old fashioned country. This result has, however, only been achieved by a very close co-operation between the State and the collective farms. Unless the State had been prepared to invest an enormous amount of capital in making it easy for the collective farms to work, and unless it had, moreover, been prepared to make the success of the collective system one of its primary purposes, I am sure that the present organisation could not have reached success. In fact, I feel (as a result of my Russian observations), if any country wished to develop a collective agricultural system its Government must make this a primary purpose of its existence and must be prepared to invest capital and energy in the struggle to make it a success, which is far beyond anything which seems to have been realised by any Government in the world outside Russia.

Let me now try to describe the organisation of a typical collective farm in Russia at the present moment. The area of such a farm may include one or more villages and its area may run from say 234 acres upto 12,000 acres though over a greater part of the main corn-growing tracts of South Russia a collective farm will usually contain some-where from 2,000 to 6,000 acres. Usually, the collective farm is made so as to include one or more villages and there has been very little

cutting up of the old villages in order to make more convenient collective farms. In 1934 the average area per household in collective farms amounted to nearly 16 acres of which it was stated that nearly 13 acres were under grain or similar crops. Naturally this figure would vary enormously over different classess of cultivation and over different parts of the country, but the figures I have given are to give an idea of what is aimed at in these farms. Owing to the demand for labour in that rapidly developing industrial system in the towns and also for extending agriculture into new tracts in Siberia and elsewhere, the area per household has tended to increase since the collective farm system was first organised about 1928. It must be realised at once that in a collectivised village a peasant must either join the collective farm or cease to hold any land at all beyond the garden attached to his own house. Membership, however, is not a right of any inhabitant of a village and members can be expelled by the general meeting of the collective farm and new members likewise admitted even from other villages.

Such a collective farm as I have described is now a legal constituted body and will have received grants of land from the State, which are to be devoted to its use for ever. Its property includes the arable land and the common grazing ground of the village central farm buidlings, work animals, implements and the common herds of cattle, pigs, sheep or poultry.

The collective farm is governed by a small committee, elected from their own members for two years. The land is worked without reference to its previous ownership in the most economic way and the actual work of the farm is carried on by "brigades" each under a leader appointed by the committee. The "brigades" contain both men and women, while the care of livestock is usually a matter for the men.

But it must be clearly understood that the cropping of such a collective farm is not entirely at the option of the committee. Each collective farm receives each year from the Government a plan specifying how much grain and similar crops is to be grown, while for cash crops they are expected to grow a definite minimum of each of the products for which the place is suitable, for sale to the State factories. In fact, a contract has to be entered into at the beginning of each year with the State factories specifying the minimum amount for which any individual collective farm will be responsible.

An agricultural expert appointed by the State is usually, though not always attached to a collective farm and his advice will normally be taken, though the committee, are not compelled to do so. Further, in a greater part of Russia the State has established what are called Machine Tractor stations and from these, implements and tractors can be hired which are beyond the capacity of each collective farm to purchase for themselves, and seed and manures can also be obtained from them. The use of all the implements for the production of a crop including the use of tractors, will usually be charged at about one-sixth to one-fourth the normal yield of the crop grown and this will be paid for in kind.

The crops are, therefore, grown by the members of the collective farm with the assistance of seed, manure and implements as well as advice obtained from the nearest Machine Tractor station. When each crop is ready for harvest the whole is reaped and remains at the disposal of the Committee, of the collective farm. From the products so obtained the charges incurred in its production, including the land revenue payable to the State, have first to be set aside. In fact, the order in which the produce is disposed of will normally be as follows:

1. Delivery of a fixed quantity of grain or other crop per acre amounting to about one-sixth of the average yield to the State. This might be considered as

a form of land revenue but it is rather in the nature of a forced sale at a price which is only a fraction of that obtainable in the market. In the great grain-growing area of the Ukraine the amount of grain delivered under this arrangement amounts to about one to one and a half maunds per acre. It is a fixed amount based on the average yield.

2. The payment to the Machine Tractor Station for supplies of the manure, seed and advice, together with the hire of implements during the growth of the crops.

After these two payments have been made the rest of the produce belongs to the collective farm. Such a proportion of it as is necessary to pay the cash requirements is sold in the market collectively, and out of money so obtained the following items are paid for (1) the subsistence wages of the members of the collective farm which have been paid during the growth of the crop, or other wages due to the workers. I will deal with these wages later; (2) the agricultural tax payable to the State and amounting to about one fortieth of the cash income (3) all costs of production other than those due to Machine Tractor station; (4) the administrative costs of the collective farm which must not exceed 2 per cent of the cash income, (5) the purchase of equipment designed to increase the production of the collective farm and (6) any other expenditure for the improvement of the collective farm which is decided upon by the general meeting.

The whole organisation is simple except so far as concerns the wages payable to the workers on the collective farm during the production of the crops. To subsistence wages paid during the growth of crops, is added the amount which is earned by the worker according to the quality of his work, so that a small amount will be payable to each worker during the growing season and, it may be a larger amount at the end of the year when the produce has been sold. The calculation of the amount due finally to any individual worker is one of the most interesting features of the collective farm system. All farm labour is divided into seven groups according to the quality of the work done. In the highest of these groups which includes the best workers on the farm, each day's work is counted as two "labour days" In the lowest grade, on the other hand, a day's work is only counted a half a "labour day". This unit of labour represents the amount which might be expected from an ordinary good labourer without special skill. If the amount of work done or the quality of work improves, the worker will be advanced to a higher group. If, on the other hand, it declines a worker may be put down to a lower group. The whole decision in this matter being made by the Committee of the collective farm.

After the payments which have been mentioned have been made the whole of the remaining produce is divided among the members of the collective farm who can store it or sell it or use it at their own free will. Most of it is, I fancy, sold to a rural co-operative society and this is the method which is generally favoured by the state authorities. Though there is no restriction on private sale of produce, yet it must be understood that this cannot lead to the growth of a private merchant's business because any such business is not permitted. If the sale, in fact is not made to a co-operative body it can only be made, at least in theory to an actual consumer.

The general system which I have described has not been reached all at once and it is quite possible that the organisation has not reached its final methods. Up to the present there has been such a demand for labour in connection with the new industrial development in Russia that there has been no pressure of population in the villages but, on the other hand the tendency has been for the number of members of any particular farm to decrease. This may not always be so and if the amount of land per member decreases it may bring back poverty

again where the collective farm system has temporarily removed it. The safeguard against this is represented of course by the enormous undeveloped areas in Russia, to which any excess population can go and will be able to go for many years to come, where every assistance will be given to new colonists who try to make an agricultural country from an undeveloped waste.

It will be seen that the system, if properly worked, should lead to the most efficient working of the land within the area of a collective farm, and as a result the actual production from the land is now tending to rise quite rapidly. To obtain this result of course means an enormous State organisation to assist the collective farm to make the best use of its land. Experience in Russia, as elsewhere has shown very clearly that there is no magic in the conversion of a large number of small scattered individual holdings into a collective farm. In fact, experience has shown that the production of such a collective farm may be less than that obtained by the members working each on his own holding. It is only where there is good leadership and satisfactory knowledge that the desired end can be achieved. And it would astonish anyone who has not been to Russia to see the amount of energy and training which has been expended in order to obtain the necessary amount of village leadership and to make available the requisite skill to the collective farms. In the absence of these two necessary things the collective farm system almost collapsed. With their gradual improvement and the consequent increase of production, the whole system seems to have passed beyond the critical stage and is now likely to become a permanent feature of rural economy in Russia.

I have not time in the present article to discuss the extent to which any similar scheme of collective farming is suitable for India. There are many difficulties in addition to those which have been met in Russia. Some of these are the intense pride in land ownership and all that this involves, the absence of undeveloped areas to anything like the same extent as in Russia into which the excess population could be drafted, the absence of industrialisation of the country to anything like the same extent as has been attempted in Russia, and finally, the existence of a large "middle-man" class whether existing as landlords, private merchants, money lenders, etc., all of whom had to be "liquidated" in Russia before the collective farm system could be a success. Unless these difficulties can be met and got rid of I do not think that the success of any collective farm system in India is likely to occur. Whether they can be got out of the way, except in a revolutionary period, is matter on which opinions may differ. But if these hindrances can be met, I think there is something to say for the collectivisation of agriculture as a means of improving the standard of life of the rural population in India, and the raising of the rural communities out of the abyss of bankruptcy in which they now lie. (*The Nagpur Agricultural College Magazine* Vol XIII No 3.)

# ABSTRACTS

**Some Biological aspects of the Storage of Fruit.** By V. H. Blackman. *Science Progress* 33 : 417—434 (January 1939).

The paper presents a review of the results of some recent biological investigations on the storage of fruits. The Introductory paragraphs are devoted to a consideration of the processes of canning and refrigeration which have greatly extended the storage life of food products by replacing the old crude processes of salting and drying. The fruit, being a senescent organ, the object of storage is to retard the rate of biological processes responsible for decay.

The author discusses the various physiological changes taking place in the fruit. Four main processes are recognised—(1) surface evaporation (2) respiration (3) radiation and (4) evolution of volatile substances. Of these, respiration, the most important process influencing the storage of fruit receives exhaustive treatment.

That there is a temperature coefficient for the rate of respiration just as there is one for chemical reactions in general, has been experimentally demonstrated by Kidd and West of the Low Temperature Research Station, Cambridge. Data are given to demonstrate the effect of temperature on the rate of respiration and on the storage life of apples. Comparing the storage life of different varieties of apples at temperatures ranging from—1°c—18°c it is shown that leaving aside the direct injurious effect of very low temperature known as "low-temperature breakdown", while the mean life at 18°c is only 6—8 weeks, the period is lengthened from 5 to 8 months at 3°c or 5°c. These data were further found to show that the temperature coefficient for the rate of decay is in the same order as that for respiration thereby demonstrating the intimate relationship between respiration and the storage life of fruits.

Interesting and remarkable correlation is brought out between the phases of life history and phases of respiration of fruits. The phases of growth and senscence of fruit were found to correspond closely to the stages of the respiration life of the fruit distinguished as (1) pre-climacteric phase characterised fall in respiratory rate, (2) the climacteric stage when the rate of the process rises marking the beginning of the senscent stage and (3) post-climacteric stage which marks the climax of the respiratory rate which then falls again. In relation to cold storage, the low temperature greatly delays the development of the respiratory maximum during which period the ripening of the fruit occurs. The negative corelation between temperature and storage life is thus explained as due to the retardation of the rate of respiration.

The author further proceeds to trace the discovery of the action of ethylene in the ripening of fruits whieh was found to be due to its power in increasing the respiratory rate thereby hastening the appearance of the climacteric rise. Commercially the substance has ,been widely used for treating horticultural produce by releasing the compressed gas from cylinders in railway trucks during transport.

The author relates another recent discovery, viz., the capacity of apples to emanate a volatile substance comparable to ethylene. This observation was further confirmed by the "pea test" method of Smith and Gane who got results consistent with ethylene as the responsible agent. Further elaborating these discoveries, Kidd and West showed that (1) the main production from apple coincides with the climacteric rise in respiratory rate and (2) apple vapour passed over other immature fruits quickly induces ripening. The surprising fact is thus revealed, that "in a population of stored apples, there is some sort of social inter action, those that ripen first influence their fellows by their exhalation and bring them rapidly to maturity." Besides apples, bananas, peaches and pears (but not oranges or grapes) were found to give off this activating vapour.

Apple vapour being comparable in its action to ethylene, the latter has been demonstrated in apple vapour and found to be produced in varying quantities in all stages of development of the fruit which suggests the inference that the initiation of ripening under natural conditions may be due to a process of auto-stimulation, the apple tissue being stimulated by its self-produced ethylene.

The author mentions the injury to fruit known as scald characterised by browning of the surface resulting from storage in closed chambers. The nature

of the injury though still obscure, is attributed to the accumulation at the surface of the fruit of some volatile substances which can be avoided by oiled paper wraps which are supposed to facilitate the absorption of these substances.

The modern gas storage developed by Kidd and West is next described; it is based upon the principle of allowing the fruit to narcotise itself by the accumulation of the end product of respiration, Carbon dioxide, during storage in closed chamber. The fruit in a closed store is however exposed to the injury resulting from the excessive accumulation of one gas over the other which in the case of certain fruits may be neutralised by "regulated ventilation" while in certain other cases the system of chemical absorption may be necessary. To get over certain difficulties like the low-temperature break down, the system of refrigerated gas storage is now extensively employed by which gas storage is combined with some degrees of refrigeration. Although the physiological aspects of gas storage are still obscure, it has been recently observed that carbon dioxide though usually depressing respiration may at some stages of growth cause a rise in respiratory rate.

In the next part of the review is discussed the place occupied by fruit anatomy, in problems of fruit storage. Emphasizing the inter-dependence between physiology and anatomy, it is stated that in a gas store "it is not the atmosphere of the store to which the fruit reacts but its own internal atmosphere". Figures are given to show the correlation between respiratory activity on the one hand and cell size and number of cells respectively on the other. Measurements of inter-cellular atmosphere showed differences in the concentration of carbon dioxide and oxygen between internal and external atmosphere and the curves of these as well as of the respiratory activity are roughly parallel when plotted against time. The ratios of the corresponding values on the two curves give some measure of the porosity of the apple.

The next portion is devoted to a consideration of the importance of previous history of fruit in relation to storage. The manurial experiments of Kidd and West showed that potassium either given alone or combined with nitrogen or phosphorus markedly increased the storage life of oranges.

In the concluding paragraphs the mycological aspects of fruit storage are discussed. Wastage in a store due to fungal invasion is controlled not only by the natural resistance of the fruit but also by the degree of infection of the surface of the fruit. The method elaborated by Gregory and Horne to estimate the rate of radial advance of the fungus which gives a measure of the resistance of the fruit concerned is described and Horne's numerous studies of resistance to fungal invasion under a variety of conditions discussed. The results showed that while potassium heightens resistance, nitrogen reduces it. Thus the increase in storage life obtained by potash manuring may certainly be due to a physiological effect of potassium in retarding fungal invasion. The resistance of apple to fungal attack is also reduced with lapse of time. V. T. B.

**The Relation of Copper and Zinc Salts to Leaf Structure.** Reed, H. S.: *Amer. Jour. Bot.* 26; (1939) 29--33.

Tomato plants grown in copper-deficient nutrient solutions showed characteristic dwarfing, involution of the leaflets, color change, and eventual necrosis. At an early stage substomal cavities were formed, resulting from the separation of palisade cells. Subsequently the separated palisade cells shrunk and ultimately disappeared as a result of the lysis of the contents, producing columniated palisade tissue. If necrosis appeared, it started in these schizogenous cavities.

Tomato plants grown in zinc-deficient nutrient solutions showed characteristic dwarfing, curvature of leaflets, chlorotic leaflets, and involuted laminae in which severe necrosis appeared early. The palisade cells were longer and the spongy parenchyma was more compact than in similar leaves from healthy plants to which zinc had been supplied. The plastids were small and contained oil drops, but there were no free oil globules in the vacuoles. Conspicuous signs of disrupted metabolism were seen in the spongy parenchyma, identifiable as scarcity of plastids, production of melanotic material, and abundance of calcium oxalate crystals. (Author's summary.)

# Research Notes.

## WILD COLONIES FOR APICULTURE—WHERE ARE THEY ?

**Introduction.** Bee-keeping on modern lines has been, in a vigorous manner, kept in public view during the last few years with the publication of interesting articles in the press and demonstration in the districts. It has drawn its votaries mainly, as is to be expected, from among the leisured and well-to-do classes of people such as retired officials, lawyers, and land-holders. But even among these people, very few seem to have regularly taken to it, although, it cannot be denied, many of them evince a great deal of interest in the art. How often one comes across gentlemen, after purchasing the artificial bee-hive box, going in search of wild colonies only to find none! How often an Agricultural Demonstrator is made responsible for the finding of a wild colony! Wild colonies—where are they? In burrows of trees, crevices of walls and all inconvenient nooks and corners!

**Pot-traps and how to arrange them.** Pot-hiving which is known in some of the coastal villages of the Vizagapatam district for the sake of honey, can with advantage be chosen as a means of trapping and rearing wild colonies for ultimately transferring them to the artificial hives. Old mud-pots of about 1 gallon capacity and of the shape of a *chatti* that is used for cooking rice should be selected. Where new pots are used they should be thoroughly washed. A hole of nearly 1-inch diameter is bored into the bottom of the pot and its mouth is covered with a lid. If the pot happens to be of a bigger size, a second hole of half-an-inch diameter is to be made out in the bottom, away from the first. In any case, the lid should tightly fit the mouth; if necessary, sticky clay or wax may be used to make the lid adhere well. The pot in that condition is hung up in a secluded place on the branch of a tree like tamarind or *Pungam* (Pongamia glabra). Care must be taken to see that the pot does not dangle in the air too violently. This can be done by properly fixing the pot to the branch with sufficient coir rope.

**Period of trapping.** The best time for arranging the above pot-traps is before the swarming season commences. Generally it will be found that the period from January to May is suitable for the purpose. Cases have occurred that within a fortnight of their being set up, the pot-traps have become the abodes of bee-colonies. In a good secluded locality, fifty per cent. success should easily be obtained within an interval of 3 to 4 months. At any rate, for one who wants to start an apiary, two or three pot-traps properly set up beforehand will certainly give atleast one wild colony which is so keenly needed at the time.

**Transference of a bee-colony from the pot to the artificial hive.** The merit of the above method does not lie merely in the obtaining of a wild colony; but the ease and freedom it offers in the process of transferring the bee-colony to the artificial hive are of considerable value to the bee-keeper. From the time the new colony of bees is observed to have settled in the pot it is necessary, to

allow a period of one or two months to elapse in order to enable the colony to build its combs and rear its brood. At the end of the period, a bright morning is as usual chosen for the operation of the final hiving. The pot-hive is brought down in tact from the branch of the tree and tied to a lower branch or a horizontal post at a height of about 4 feet from which the operator can easily work. A few gentle knocks would bring down the entire bottom of the pot and the whole hive is exposed to the operator's eyes and, the rest can be performed in a comfortable fashion. The result of the operation is always a complete success since during the process very little violence would be found necessary to disturb the equanimity of the colony.

**Conclusion.** Pot-trap may usefully be employed as a means of obtaining a wild colony at hand. The advantages of this method are that it entails little or no extra expenditure, gives the least trouble in hiving into the artificial box and offers cent per cent success.

Chodavaram, }
21—2—'39. }

G. V. Ratnam,
Agrl. Demonstrator.

# Gleanings.

**Selecting the Deep Sucker in Banana Culture** As the result of the favourable seasonal conditions, banana plantations are now making a flush of suckers. On the selecting of the best sucker on each plant will depend the success of the following crop and the future life of the plantation.

The corm of a banana plant produces at least two rings of buds which at growing periods burst into growth. Of these, the top circle is about 2 inches from soil level and the lower circle is usually 2 or 3 inches below the top circle. Suckers from any of these buds do not send forth the correct follower.

At the base of the corm a bud is produced which brusts into growth at a particular stage in the life of the parent plant. From plantation trials extending over several years it has been found that the parent plant sends out the correct follower sucker when it has made three quarters of its growth.

The maturity of a banana plant is governed, not by the time it is in the soil, but by the nature of the conditions during its growth. The deep flower produced at the right stage by the parent plant has more vitality, and its roots are deeper, and it retains its sword leaves longer. The shallow follower, on the contrary, develops its mature foliage early, and the corm rises above soil level, thereby preventing the effective functioning of its higher roots.

The careful digging out of a three quarter mature plant will reveal the habit of sucker formation, both shallow and deep. If suckers are planted with the side of severance downhill, the general experience is that the correct follower will invariably appear just where it is wanted—i. e., uphill. (*Queensland Agricultural Journal*, Vol. LI, part 1, January 1939.)

**Dairy Cattle—Pure-Bred or Grades ?** The question is often asked : Which is the more profitable pure-bred or grade daily cattle ? The difference in value of pure-bred and high grade dairy cattle lies in the higher selling price of the pure-bred. Dairy farms which are so equipped that they can handle the record work effectively will find more profit in pure-bred than in grade cattle. There is a steady market for high quality pure bred cattle at prices which get good returns to the breeder. Whether pure-bred stock will show the best results with any particular dairy farmer depends, however, on his keeping authentic records and also on his ability as a salesman. Pure-bred cattle which a breeder is unable to sell are no more valuable to him than an equal number of good grades.

A herd of carefully selected grade cows will produce as heavily as the average pure-bred herd for the reason that they can be culled more closely, as their lower value does not encourage keeping an animal which is not a profitable producer, There is always a good demand for the female offspring at payable prices. Any person going in for dairying for the purpose of producing milk or cream, and not with the idea of gaining a large part of his income from the sale of stock, may do quite as well with grades as with pure-breds.

As in most things, success with dairy cattle depends on the individual farmer himself, and whether grade or pure-bred cattle are more desirable can be settled only when the particular conditions surrounding the individual case are considered.

It is sometimes stated that grade cows are better than pure-bred animals. This is not so, but it is true that some grades are better than some pure-bred stock.

One very important fact to remember, however, is that the herd sire should always be a pure-bred. Unfortunately, this is not sufficiently understood by some Queensland dairy farmers, and this accounts to a very large extent for the poor type of dairy cattle one sometimes sees when travelling through the country. (*Queensland Agricultural Journal,* Vol. LI, part 1, January 1939.)

**Honey Dip for Ice Cream.** If you wish to know what is really delicious, take a good grade of table honey and drizzle or pour it slowly over the surface of a dish of ice cream. The honey will congeal, that is, its viscosity will increase, so that the honey becomes waxy, and when this waxy honey and ice cream are eaten together, it makes a delicious mouthful. Try it out and see for yourself. When you have done that, go to the ice cream dispensers in your town and give a demonstration of how honey enhances the palatability of ice cream. (*Gleanings in Bee Culture*, Vol. LXVII, No. 1, January 1939).

# Correspondence.

To

The Editor, Madras Agricultural Journal.

Sub. :—**Bamboos in flowers.**

Sir,

Since the flowering of bamboos is a rare phenomenon I thought it might interest the readers to know that bamboos have flowered this year in profusion. Flowering had commenced some weeks back and has been uniform and complete in both the solid and hollow varieties; both the young and old culms in the same clump have borne flowers very heavily. Perhaps this is about the best time for collecting seeds for raising bamboo in few areas.

The association of the flowering of bamboos with famine conditions is well-known. Older generation are still able to recall a similar flowering about 48 years ago in the Hindu cycle year 'Kara' when acute famine conditions prevailed. The continued prevalence of famine conditions now would seem to synchronize with flowering of bamboos again. Will any of your enlightened readers kindly let me know through the columns of your esteemed journal how and why the flowering is forced up in times of drought and whether this phenomenon has been observed in other parts of this presidency.

Chingleput,
30—3—'39.

(Sd.) K. Varadachari.

# Agriculture in the Madras Legislature.

[The following is a press report of the proceedings of the 1939 budget session of the Madras Legislative Assembly relating to the Agricultural grant.—*Ed. M. A. J.*]

In the Madras Legislative Assembly the Hon. Mr V. I. Muniswami Pillai, Minister for Agriculture and Rural Development, moved that the Government be granted a sum not exceeding Rs. 20,11,100 under "Agriculture" in the budget for 1939-40.

Mr. G. Krishna Rao, (Northern Central Landholders) proposing a "cut" motion, complained that the Agricultural Department was static and had not helped agricultural progress in the province. The results of experiments conducted by the department and of the scientific work conducted at research stations had not been taken to the door of the ryot. There was, on an average, one demonstrator for each taluq; but as each taluq comprised about 300 villages the demonstrator could not serve the needs of even a small percentage of the ryots.

There was a wide gap between research station and the ryots and unless the results of research were carried to the ryots the department could not be said to have served its purpose.

The member wanted to know whether the Government had decided upon any definite policy on the application of electro-culture to agriculture.

*Scientific Work.* Mr. D. M. Reid (European Group) said agriculturists should follow the advice which the Agricultural Department offered them and benefit by the valuable results of scientific work.

He pointed out that agriculture was of supreme importance to the country and that those engaged in industry, in the professions and, in fact in any walk of life, depended upon the prosperity of the agriculturists.

He showed the House a copy of the Villager's Calendar (priced one anna) published every year by the Agricultural Department and congratulated the Government on the publication. It was an excellent production and he wished that everybody read that book. He did not know, whether it was being published in the provincial languages also.

The Premier, by a nod of his head, indicated that it was being published in those languages.

Mr. Reid hoped that every agriculturist would follow the valuable advice contained in it.

He then referred to a Government *communique* on the working of the Mettur reservoir and congratulated the Minister for Public Information on that *communique*. He referred to a passage on irrigation, and said that the passage explained perfectly how the agriculturist should use the water available for irrigation.

The Agricultural Department was publishing valuable literature; but that literature should be studied by the people, he pleaded.

Mr. Reid added that he had already made certain alternative proposals for spreading education in agriculture among the people. His alternatives were that the students of all colleges should work on the fields for some time before they were considered qualified for their diplomas or degrees; or that agriculture should be included in the syllabus as a compulsory subject for the S. S. L. C. examination. Another suggestion was that all people, both Europeans and Indians, should be given some instruction in agriculture as a necessary feature in the training for citizenship.

*More Maistries Needed.* Mr. Abdur Rahman Khan (Kurnool, Muslims) said the Agricultural Department had not been able to take complete stock of the situation of agriculturists so that their interests could be advanced. They needed education—education not for University degrees but education that would enable them to understand how they could improve agriculture. Government, however, had not been slow in recognising the value of propaganda.

The department should utilise to a greater degree, the services of agricultural maistries who came in intimate contact with the agriculturists in villages and who, therefore, knew their exact needs and difficulties. Government should not only have a large number of demonstrators but also a large number of maistries. The department should assign plots of land to agricultural demonstrators.

Mr. T. N. Ramakrishna Reddi (Madanapalli) said Government had appointed an agricultural demonstrator in each taluq. The mere appointment of demonstrators would not impart scientific knowledge of agriculture to ryots. Cooperation of the people was needed for the improvement of agriculture.

*Imports of Fruits.* Mr. Malang Ahmed Badsha (North Arcot, Muslims) said he did not think that any cleavage could be introduced between an agriculturist and a merchant. It was regrettable that India had to import apples from Japan, pineapples from Singapore and other fruits from California. It was a great humiliation to them, who claimed to be agriculturists from time immemorial. Could they not grow these fruits in their own country? The Government should consider this aspect of agriculture. The people also imported honey from other countries when their country was able to produce excellent honey.

Mr. Ahmed Badsha added that the total loss to this province on account of the practice of branding animals was between Rs. 30 and Rs. 40 lakhs. Hide that could be sold for Rs. 4 was sold for Rs. 3 on account of the damage caused by the branding of animals. Government should consider this matter and bring in legislation to prevent branding of animals.

Even human beings were branded on account of superstition.

Mr. M. Subba Rao (Rajahmundry Rural) suggested that agriculture in the Presidency should be improved on new lines. Demonstrators had not discharged their duties properly.

In Cuddapah, during the past 20 years, new fruit farms had been established but they were destroyed by some disease. The Government should assist the ryots to combat the disease. More marketing facilities should also be provided.

Mr. Sheik Mansoor Tharaganar (Tinnevelly, Muslim) said the Government should arrange to broadcast through the radio and the cinema the necessary information to agriculturists on economic methods of cultivation.

Mr. A. Subramaniam (Tirukoilur) said the Congress Government had done during the last 20 months more than what the Justice Party had attempted to do during the previous twenty years to improve the condition of agriculturists. During the remaining three years of office the Government would redress all grievances of the ryots.

Swami Sahajananda (Chidambaram, Scheduled Castes) said the poor agricultural labourers were helpless and uncared for. Though the Congress Government had done something for them, much remained to be done to improve their lot. The Government should undertake legislation to fix their hours of work and their wages. They should also make arrangements for educating the labourers' children.

Mr. Ramaswami Gounder (Palladam), speaking as an agriculturist, urged that the methods of work of agricultural demonstrators should be improved. The

demonstrators should identify themselves with the cultivators and apply their scientific knowledge to practical agriculture. They should move among the ıyots freely and promote scientific methods of agriculture in a manner that would appeal to the cultivators.

He also pleaded that agriculture should be included in the elementary school syllabus.

*Minister's reply.* The Hon. Mr. V. I. Muniswami Pillai, Minister for Agriculture, replying to the debate, thanked Mr. D. M. Reid for his impartial view of the results of the work of the Agricultural Department under the present Government. Mr. Krishna Rao, the Minister regretted, had made sweeping remarks and had not studied the work of the department during the last 12 months.

Immediately after the present Government came into existence the Agricultural Department was reorganised, the number of Deputy Directors being reduced by 50 per cent. and that of Assistant Directors trebled. The number of agricultural demonstrators was increased by 30 posts so that one demonstrator might be appointed for each taluq. A maistry had been appointed to assist each demonstrator and there was a reserve of 45 maistries.

The department was not concerned with research alone. It undertook various other activities, such as evolving improved manure and seeds and promoting facilities for marketing the produce. The Department had produced various new strains of seeds and performed much valuable practical work.

He quoted figures showing increased cultivation of various crops such as cotton, potatoes and sugarcane, and pointed out that during the year 1937–38 the acreage had increased considerably over that of the previous year.

The Department had made great strides in improving the quality of crops.

*Soil Analysis.* He referred to charts showing the prices realised for various products and pointed out that they fetched better prices than they did formerly. Last year it was possible for the Department to analyse 2,541 soils from various parts of the Presidency and it was also possible to do research in regard to 46 kinds of grass in Coimbatore.

A member had referred to grants given to farmers in Orissa. But he would say that the Government of Madras had gone a step further. They had not only given grants but had also helped the farmers to sell their produce.

During the year 1937–38 loans amounting to Rs. 62·12 lakhs were given on the security of produce as against Rs. 26·16 lakhs in the previous year. The Department had also been giving grants to agricultural societies to construct godowns and also loans to the societies at the low rate of 3½ per cent.

*Electro-Culture.* The question was asked whether the Government had undertaken experiments under electro-culture. They deputed an officer to the United Provinces to study what was being done there in regard to electro-culture. This officer had come back and was making experiments. They expected to know the results in June.

Mr. Abdur Rahman Khan had said that much propaganda was not done. He would invite Mr. Abdur Rahman Khan to visit the various agricultural exhibitions held in the districts. Those exhibitions gave an idea of the activities of the Department.

Agricultural demonstrators were asked to tour at least 20 days in a month and were given opportunities to establish demonstration centres for better crops.

*Fruit Research.* Referring need to Mr. Ahmed Badsha's remarks about fruit growing and fruit research, the Minister said Government had established research stations in different centres in the Presidency, particularly at Kodur.

The member had also referred to the inadequacy of arrangements for the encouragement of bee-keeping. Government were doing all that they could to spread the industry throughout the Presidency.

Government had also circulated leaflets and pamphlets urging the people to stop the cruel habit of branding animals.

It was said that the posts of Agricultural Deputy Directors should be abolished. Government, after examining the position, had come to the conclusion that there should be four such Deputy Directors to cover the whole Presidency.

The Minister then gave the substance of his reply in Tamil for the benefit of members who did not know English.

Mr. G. Krishna Rao having withdrawn the "cut" motion, the demand was granted.

# Crop and Trade Reports.

**Groundnut—1939—First Report.** The area sown with the summer or irrigated crop of groundnut during the three months January to March 1939 is estimated at 46,400 acres. When compared with the estimated area of 51,400 acres for the corresponding period of last year, there is a decrease of 9·7 per cent.

Figures by districts are given below:—

| District. | Estimate of area sown with irrigated groundnut from January to March. 1939 | 1938 | Increase (plus) or decrease (–) of the area in col. (2) as compared with area in col. (3). |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| | Acres | Acres | Acres |
| Anantapur | 300 | 300 | Nil |
| Cuddapah | 2,000 | 2,000 | Nil |
| Nellore | 100 | 100 | Nil |
| Chingleput | 6,000 | 12,000 | – 6,000 |
| South Arcot | 20,000 | 20,000 | Nil |
| Chittoor | 5,000 | 6,000 | – 1,000 |
| North Arcot | 2,000 | 1,500 | + 500 |
| Trichinopoly | 2,000 | 1,000 | + 1,000 |
| Tanjore | 3,000 | 1,500 | + 1,500 |
| Madura | 5,000 | 5,000 | Nil |
| Ramnad | 1,000 | 2,000 | – 1,000 |
| Total | 46,400 | 51,400 | – 5,000 |

The wholesale price of groundnut (shelled) per imperial maund of 82 2/7 lb. (equivalent to 3,200 tolas) as reported from important market centres on 11th April 1939 was Rs. 4–3–0 in Cuddalore, Rs. 3–15–0 in Vizagapatam and Anantapur, Rs. 3–14–0 in Guntur, Rs. 3–12–0 in Vizianagaram, Rs. 3–8–0 in Vellore, Rs. 3–6–0 in Cuddapah. Rs. 3–4–0 in Nandyal and Tadpatri, Rs. 3–3–0 in Bellary and Rs. 3–2–0 in Adoni and Hindupur. When compared with the prices published in the report for the corresponding period of the previous year, i. e., those which prevailed on 4th April 1938, these prices reveal a rise of approximately 19 per cent. in Anantapur, 8 per cent. in Nandyal, 6 per cent. in Bellary, Cuddapah and Vellore, 4 per cent. in Tadpatri and 3 per cent. in Guntur, the prices remaining stationary in Vizianagaram, Adoni and Hindupur.

**Gingelly--1938-1939—Fourth or final report..** The average of the areas under gingelly in the Madras Province during the five years ending 1936-1937 has represented 15·4 per cent of the total area under gingelly in India.

The area sown with gingelly in 1938-1939 is estimated at 821,000 acres. When compared with the area of 814,400 acres estimated for the corresponding period of last year, it reveals an increase of 0·8 per cent. The present estimate also reveals an increase of 3·3 per cent as compared with the finally recorded area of 794,875 acres last year. The area in an average year is estimated at 764,060 acres.

245,700 acres have been reported as sown since the previous forecast report was issued in January as against 268,000 acres during the same period last year. These late sowings were mainly on wet lands in Vizagapatam, East Godavari, West Godavari, Cuddapah, Nellore, South Arcot, Trichinopoly and the South where gingelly was raised as a second crop after paddy.

As compared with the actual area sown last year, there has been an increase in area in the Circars (Vizagapatam excepted), the Deccan (Kurnool excepted) Nellore, Chittoor, Trichinopoly, Madura and Tinnevelly, partly counterbalanced by a decrease in the other districts.

The yield is estimated to be normal in East Godavari, Guntur, Kurnool, Ramnad, Tinnevelly and South Kanara and below normal in the other districts, especially in Coimbatore (66 per cent), Trichinopoly (67 per cent), and South Arcot (70 per cent) owing mainly to drought. The condition of the late sown crop is generally fair.

The seasonal factor for the Province as a whole works out to 87 per cent of the average as against 89 per cent according to the Season and Crop Report of last year. On this basis, the yield is estimated at 96,300 tons as against 95,900 tons according to the Season and Crop Report of last year and an average yield of 104,020 tons.

The wholesale price of gingelly per imperial maund of 82$\frac{2}{7}$ lb. (equivalent to 3,200 tolas) as reported from important markets on 11th April 1939 was Rs. 6—9—0 in Trichinopoly, Rs. 6—2—0 in Tinnevelly, Rs. 6—1—0 in Salem, Rs. 6 0—0 in Cocanada, Rs. 5—14—0 in Cuddalore, Rs. 5—11—0 in Tuticorin, Rs. 5—10—0 in Vizagapatam, Rs. 5—8—0 in Vizianagaram, Rs. 5—7—0 in Rajahmundry and Rs. 5—1—0 in Ellore. When compared with the prices published in the last report, i.e., those which prevailed on 6th February 1939, these prices reveal a rise of approximately 13 per cent in Vizagapatam, 11 per cent in Tuticorin, 7 per cent in Vizianagaram and 4 per cent in Cocanada and a fall of 9 per cent in Ellore, 8 per cent in Rajahmundry and Tinnevelly, and 5 per cent in Cuddalore, the prices remaining stationary in Salem and Trichinopoly.

*(From the Director of Industries and Commerce, Madras.)*

**Cotton Raw, in the Madras Presidency.** The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 21st April 1939 amounted to 109,779 bales of 400 lb lint as against an estimate of 375,800 bales of the total crop of 1938-39. The receipts in the corresponding period of the previous year were 106,643 bales. 105,385 bales mainly of pressed cotton were received at spinning mills and 30,299 bales were exported by sea while 56,692 bales were imported by sea mainly from Karachi, Bombay and Egypt.

*(From the Director of Agriculture, Madras).*

# College News and Notes.

**Students' Corner.** The University Examinations for the B. Sc. Degree in Agriculture commenced on the 3rd of this month. The theory portion was completed on the 24th instant.

On 28—3—39, the 1st and 2nd year B. Sc. (Ag.) students were 'At home' at the Freeman Hall to the outgoing final year and short course students. After tea, speeches on behalf of lecturers, tutors, and coaches were made The function came to a close with an appeal by the Principal to the outgoing students to become active members of the Madras Agricultural Students' Union.

**Personal.** On the eve of his transfer from Coimbatore to Madras as Headquarters Dy. Director of Agriculture, Sri. K. Unnikrishna Menon was entertained at dinner on 28—3—39 by some of his friends and admirers at the Officers' Club.

**Visitors.** Sri. K. Lakshmana Rao, Madura, Honorary visitor, visited the Agricultural College and Research Institute on 5—4—39.

As examiners for the University Examinations for the B. Sc. (Ag.) Degree in Agriculture, the following gentlemen visited the Estate :— Sri. Bachina Ramayya, Dy. Director of Agriculture, I circle, Cocanada, Sri. B. C. Appadurai Mudaliar, Industrial Engineer to the Government of Mysore and Sri. G. Krishnaswami Mudaliar, Retired Veterinary Assistant Surgeon.

# Notifications.

The following letter dated Calicut, the 10th April 1939 has been received by the Secretary, Madras Agricultural Students' Union from the Kerala Plantations Limited, The Madras Peoples Bank premises, Oyitty Road, Calicut. Intending applicants may submit their application direct to the Kerala Plantations Limited :

We shall esteem it a favour if you will assist us in getting a suitable Graduate in Agriculture to take charge of the Estates belonging to the above plantation Company. The Estates are situated in Malabar District.

The candidates you recommend should be below 32 years of age and physically fit to reside on the Estates.

We are agreeable to offer him an initial salary of Rs. 50 plus an allowance of Rs. 10 and free quarters on the Estate. He will be on probation for a period of 6 months and will be confirmed if his work is found satisfactory. The candidates whom you recommend may have to interview the Visiting Director of the Company (M. R. Ry. Rao Bahadur N. S. Kulandaiswami Pillai Avl., Dy. Director of Agriculture (retired) Crawford, Trichinopoly).

For the right type of Graduate the job we offer will be found very attractive and remunerative in due course.

The jollowing letter 569/39 E. dated 14—3—39 received by the Principal, Agricultural College, Coimbatore, from the District Forest Officer, Salem North, Hosur Cattle Farm, has been sent to us for publication in the Journal.

'I thank you for your letter under reference, and for having notified my requirements through the Secretary, Madras Agricultural Students' Union.

As a result of the notice, I have received six applications so far ; one is from a present student of your college and another from a man who has had some experience in collecting and insect pinning work. I am appointing both these as fieldmen. The remaining 4 applicants have had no experience whatever in collecting insects and are mere S. S. L. C.'s.

I shall be greatly obliged if you will very kindly have it notified that the applicants for the fieldmen's posts in this division should have some Entomological knowledge, in addition to the qualifications already specified'.

# Weather Review—MARCH 1939.

RAINFALL DATA

| Division | Station | Actual for month | Departure from normal @ | Total since January 1st |
|---|---|---|---|---|
| Circars | Gopalpore | 1·4 | −0·9 | 1·4 |
| | Calingapatam | 0·2 | −0·2 | 0·4 |
| | Vizagapatam | 2·7 | +2·4 | 2·7 |
| | Anakapalli* | 1·5 | +1·0 | 1·6 |
| | Samalkota* | | | |
| | Maruteru* | 1·1 | 0·0 | 1·2 |
| | Cocanada | 2·0 | +1·5 | 2·2 |
| | Masulipatam | 0·4 | +0·1 | 0·4 |
| | Guntur* | 0·5 | +0·3 | 0·5 |
| Ceded Dists. | Kurnool | 0·0 | −0·3 | 0·0 |
| | Nandyal* | 0·1 | −0·1 | 0·1 |
| | Hagari* | 0·0 | −0·2 | 0·0 |
| | Siruguppa* | 0·1 | −0·2 | 0·1 |
| | Bellary | 0·0 | −0·2 | 0·0 |
| | Anantapur | 0·0 | −0·2 | 0·0 |
| | Rentachintala | 1·0 | ... | 1·0 |
| | Cuddapah | 0·4 | +0·3 | 0·5 |
| | Anantharajupet* | 0·6 | +0·5 | 3·5 |
| Carnatic | Nellore | 0·1 | −0·1 | 1·1 |
| | Madras | 0·2 | 0·0 | 0·9 |
| | Palur* | 0·3 | −1·6 | 3·3 |
| | Tindivanam* | 1·1 | −0·4 | 1·7 |
| | Cuddalore | 0·3 | +0·1 | 3·8 |
| Central | Vellore | 0·3 | +0·1 | 2·3 |
| | Salem | 0·9 | +0·4 | 1·5 |
| | Coimbatore | 0·4 | −0·1 | 2·7 |
| | Coimbatore A. C. & R. I.* | 0·5 | −0·3 | 2·6 |
| | Trichinopoly | 0·0 | −0·4 | 1·9 |

| Division | Station | Actual for month | Departure from normal @ | Total since January 1st |
|---|---|---|---|---|
| South | Negapatam | 0·2 | −0·1 | 1·6 |
| | Aduthurai* | 0·3 | −1·1 | 2·7 |
| | Madura | 1·3 | +0·8 | 2·6 |
| | Pamban | 0·0 | −0·5 | 3·3 |
| | Koilpatti* | 0·2 | −0·7 | 2·8 |
| | Palamkottah | 0·7 | −0·3 | 3·0 |
| West Coast | Trivandrum | 0·2 | −1·4 | 1·3 |
| | Cochin | 2·3 | +0·3 | 2·3 |
| | Calicut | 0·0 | −0·5 | 0·1 |
| | Pattambi* | 1·1 | +0·1 | 1·1 |
| | Taliparamba* | | | |
| | Kasargode* | 0·0 | −0·5 | 0·0 |
| | Nileshwar* | 0·0 | −0·3 | 0·0 |
| | Mangalore | 0·0 | −0·1 | 0·0 |
| Mysore and Coorg | Chitaldrug | 0·0 | −0·2 | 0·0 |
| | Bangalore | 0·4 | −0·1 | 1·0 |
| | Mysore | 0·8 | +0·5 | 1·1 |
| | Mercara | 0·1 | −0·5 | 1·0 |
| Hills | Kodaikanal | 0·9 | −1·1 | 9·4 |
| | Coonoor | | | |
| | Ootacamund* | 0·9 | −0·2 | 2·3 |
| | Nanjanad* | 1·4 | +0·3 | 2·6 |

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette

During the 3rd week of the month there were isolated thundershowers in the Peninsular area. Rainfall was slightly in excess in the Circars and defective elsewhere.

Skies were moderately to lightly clouded in South East Madras and North Madras Coast and the humidity was in large defect.

**Weather Report for Agricultural College & Research Institute.**

Report 3/39.

| | |
|---|---|
| Absolute maximum in shade. | 99·0°F |
| Absolute minimum in shade. | 59·5°F |
| Mean maximum in shade. | 95·3°F |
| Departure from normal. | + 0·5°F |
| Mean minimum in shade. | 67·2°F |
| Departure from normal. | − 2·5°F |

| | |
|---|---|
| Total rainfall for the month. | 0·5" |
| Departure from normal. | – 0·3" |
| Heaviest fall in 24 hours. | 0·5" |
| Number of rainy days. | 1 |
| Mean daily wind velocity. | 2·6 m. p. h. |
| Departure from normal. | – 0·1 m. p. h. |
| Mean humidity at 8 hours. | 60·8 % |
| Departure from normal. | – 8·9 % |

**Summary.** Excepting for a thundershower on the 17th the weather was dry throughout the month. The rainfall was slightly in defect. The mean maximum temperature was very nearly normal while the mean minimum was below normal. Skies were lightly to moderately clouded and the humidity was in large defect.

P. V. R. & F. L. D.

# Departmental Notifications.

## *Gazette Notification.*

### Appointments and Transfers.

Sri K. Unnikrishna Menon, Assistant Director of Agriculture and Officiating Deputy Director of Agriculture, IV Circle, Coimbatore, in Category 4, class I Madras Agricultural Service is appointed to category 2, Class I, Madras Agricultural Service, and to officiate as Headquarters Deputy Director of Agriculture, Madras, vice Sri K. T. Alwa on leave.

Sri C. Ramaswami Nayudu, Junior Lecturer in Agriculture and Assistant Superintendent, Central Farm, Coimbatore is appointed to category 4—class I Madras Agricultural Service and to officiate as Deputy Director of Agriculture IV circle, Coimbatore vice Sri K. Unnikrishna Menon.

| Name of officers | From | To |
|---|---|---|
| Sri L. Narasimha Acharya, | Offg. Asst. D. A., Nellore, | A. D., Chittoor. |
| ,, R. N. K. Sundaram, | Asst. D. A., Madura (on leave) | Asst. D. A., Nellore. |

## *Subordinate Services.*

### 1. Transfers.

| Name of officers | From | To |
|---|---|---|
| Sri C. S. Gopalaswami Rao, | Asst. in Mycology, Guntur | Asst. Mycology, Coimbatore. |
| ,, M. Royappa Pillai, | Asst. in Millets, Coimbatore, | Offg. Asst. in Paddy Section, Coimbatore |
| ,, A. Mariakulandai, | Offg. Asst. in Millets, Coimbatore, | Offg. Asst. in Chemistry, Coimbatore. |
| ,, James Colaco, | Offg. Asst. in Chemistry, Coimbatore, | Offg. F. M., A. R. S., Nanjanad. |
| ,, R. Krishnamurthy, | | F. M., A.R. S., Kovilpatti. |
| ,, V. Chidambaram Pillai. | F. M., A. R. S., Kovilpatty, | A. D., Tinnevelly. |
| ,, S. Ramachandran, | A. D., Tinnevelly, | A. D., Mudukalathur. |
| ,, S. V. Parthasarathy, | A. D., Chittoor, | A. D., Trivellore. |
| ,, P. Seshachalam Naidu, | A. D., Kaikalur, | A. D., Narasapur. |
| ,, B. P. Papayya, | Asst. A. D., Narasapur, | Asst, A. D., Kaikalur. |
| ,, K. Parameswara Menon, | A. D., Dharmapuri, | A. D., Palghat. |
| ,, P. V. Hanumantha Rao, | A. D. (on leave) | A. D., Vridhachalam. |
| ,, R. Venkataramana Iyer, | Asst. A. D., Vridhachalam, | Asst., A. D., Mayavaram. |

## 2. Leave.

| Name of officers. | Period of leave. |
|---|---|
| Sri J. D. David, Lecturer in Animal Hygiene, Coimbatore. | L. a. p. for 1 month from 24—4—39. |
| „ P. S. Venkatasubramaniam, F. M., A. R. S., Tindivanam. | L. a. p. for 15 days from 12—4—39. |
| „ U. Ananda, F. M., A. R. S., Pilicode. | L. a. p. for 13 days from 17—4—39. |
| „ S. Ramarao, A. D., Udayagiri. | L. a. p. for 1 month from 25—4—39. |
| „ S. Dharmalingam, Asst. in Paddy, Coimbatore. | Extension of l. a. p. for 23 days from 6—4—39. |
| „ V. Ratnaji Rao, A. D., Sulurpet. | L. a. p. for 21 days from 20—4—39. |
| „ B. Narasimha Pattathan, Asst., A. D., Puttur. | L. a. p. for 1 month from 12—4—39. |
| „ B. G. Narayana Menon, Offg. F. M., A. R. S., Nileswar. | L. a. p. for 30 days from 12—4—39. |
| „ N. C. Tirumalachary, F. M., Cotton Breeding Station, Coimbatore. | L. a. p. for 1 month from the date of relief. |
| „ K. C. Thomas, F. M., Central Farm, Coimbatore. | L. a. p. for 2 months from 12—4—39. |
| „ G. Ranganathaswami, F. M., A. R. S., Anakapalli. | L. a. p. on m. c. for 1½ months from 16—4—39. |
| „ S. Muthuswami, A. D., Tiruttani. | L. a. p. for 4 months from 12—4—39. |
| „ K. Hanumantha Rao, A. D., Rajampet. | L. a. p. for 2 months and 2 days from 27—2—39. |
| „ M. Krishnaswami Ayyangar, Asst., A. D. (on leave). | L. a. p. for 6 weeks from 18—3—39. |
| „ P. Nagadhara, A. D. (on leave). | L. a. p. for 1 month and 15 days from 19—4—39. |
| „ K. Achuthan Nambiar, Asst., A. D., Mycology, Tellichery. | L. a. p. for 2 months from 12—4—39. |
| „ K. S. Ramana Rai, A. D., Moodbidri. | L. a. p. on m. c. for 1 month from the date of relief. |
| „ P. Gopalakrishnan, F. M. (on leave), Nanjanad. | L. a. p. for 2 months and 10 days from 15—3—39. |
| „ U. S. Ayyaswami Ayyar, A. D., Mayavaram. | L. a. p. for 4 months from 3—4—39. |
| „ M. Gopala Unnithan, A. D., Gudiyatam. | L. a. p. for 1½ months from 2—5—39. |
| „ P. Kesavanunni Nambiar, A. D., Palghat. | L. a. p. for 20 days from 12—4—39. |

# Agricultural College and Research Institute
# Coimbatore.

## Additions to the Library During March 1939.

### A. Books.

1. *Irrigation: A Selected Bibliography.* Graf, D. W. (1938). 2. *Plant Chemiculture: A Guide to Experiments in growing plants without soil.* Dawson, C. D. and Dorn, M. V. (1938). 3. *Morphological and Physiological studies on the fruitification of Peanut.* Shibuya, T. (1935). 4. *The Citrus Industry of South Africa.* Neumark, S. D. (1938). 5. *XIIth International Horticultural Congress.* (1938). 6. *Storage and Transport of Tropical Fruits and Vegetables.* Wardlaw, C. W. (1937). 7. *Manual for the Determination of Seed Borne Diseases.* Doyer, L. C. (1938). 8. *Background to Modern Science.* Needham, J. & Pagel, W. (1938).

### B. Annual Proceedings and Reports.

1. Karachi Cotton Annual 1937-38. 2. Progress Reports from Experiment Stations of E. C. G. C. for 1937-38. 3. Proceedings of the 12th Annual Congress of the South African Sugar Technologists' Association held in Durban 4th—7th April, 1938. 4. Year Book of Agriculture of the United States Department of Agriculture for 1938. 5. Annual Report of the Department of Agriculture—Tanganyika Territory Part II, 1937. Annual Report of the Department of Agriculture—Kenya Vol. 1, 1937. 7. Annual Report of the Director, Purdue University for 1937. 8. Annual Report of the Department of Agriculture and Conservation of Rhode Island and Providence Plantations for 1937.

### C. Special Reports and Publications.

9. Report on the Cost of Production of Crops in the Principal Sugarcane and cotton tracts in India Vol. IV Madras, I. C. A. R. 10. Report on the Cost of Production of Crops in the Principal Sugarcane and cotton tracts in India Vol. V Bihar, 1938. 11. Report on the Cost of Production of Crops in the Principal Sugarcane and cotton tracts in India Vol. VI Bengal, 1938. 12. Summary of Fertilizer Experiments carried out by I. C. I. from April 36 to March 1938 Vols. 1 and 2. 13. I. C. A. R. Report on a Village Enquiry re. Cattle and the Production and Consumption of Milk in seven Breeding tracts of India, 1938. 14. A Brief Survey of some of the Important Breeds of Cattle in India, Pt. II. 15. Definition of Characteristics of Seven Breeds of Cattle of All India Importance. 16. Cold Storage of Fruits and Vegetables. I. C. A. R. Miscellaneous Bulletin No. 2 by C. S. Cheema, D. Sc., I. A. S., and D. V. Karmarkar, M. Sc., Ph. D., A. I. I. Sc.